FACULTY OF COMPUTER SCIENCE AND INFORMATION TECHNOLOGY

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Perpustakaan SKTM

Interactive Web Based Learning System for Software Requirements Engineering Course

BY

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This project is submitted to the Faculty of Computer Science and Information Technology, University of Malaya in partial fulfillment of the requirements for the Bachelor of Computer Science

Session 2004/2005

Abstract

Interactive Web Based Learning System for Requirement Engineering Course is a web-based course information system developed to facilitate the teaching and learning process of Software Requirement Engineering Course at Faculty Computer Science & Information Technology, University of Malaya.

This Web Based Learning System is designed to create an information-rich environment of education resources, which can be obtained at any time from any place to save the users' time. The system is divided into two main modules, which are lecturer's module and student's module.

The Web Based Learning System serves as an alternative method for a lecturer to run a course. It allows lecturer to perform the course and lecture notes maintenance, tutorial maintenance, assignment maintenance as well as apointment. In other hand, the system enables the students who take Software Requirement Engineering Course to submit their assignments and get the teaching materials faster. It is more secure and time-saving conducting these events throughout the system.

The users can use this system as long as the connection to the web server and database server is established. The users have to logon to the system to enter either lecturer's or student's section. Therefore, this system gives better quality education, services, and facilities to the both students and lecturer.

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Acknowledgement

First and foremost, I would like to express my deepest gratitude and thanks to my beloved project supervisor, Puan Norazlina Bt. Khamis who has been so friendly, patient, and kind throughout the development of Interactive Web Based Learning for Requirement Engineering Course. Her continuous guidance and concerns has helped me a lot and her willingness to listen to the problems as well as questions related to the project is much appreciated.

In addition, I would like to thank my project moderator, Puan Azwina for her constructive comments and suggestions during my proposal presentation and providing me with more ideas and opinions on building a better Web Based Learning System application.

Never forget also to my family members, friends, and coursemates for offering ideas and opinions personally to me in order to solve problems related to the project. The completion of this project will not be accomplished without their assistance. Last but not least, thanks a lot for all of your help, cooperation, and support. Thanks you very much.

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Chapter 1 : Introduction

1.1 Project Overview

Interactive Web-based Learning is a web-based system runs through Internet with a centralized database and it is designed based on client-server architecture. The main purpose of the system is to provide better quality education, services and facilities to students. The system also facilitates lecturer in aspect of giving out notes, tutorials, submission of assignment as well as enhancing the interaction between students and lecturer or students and students, such as making an appointment with lecturer online.

The system offers features like downloading and uploading notes, tutorials and assignments for both students and lecturer. Students can obtain any learning materials and submit their assignments for the course easily through this web-based system.

Apart from that, this system is secure and time-saving to handle before and after lecture, tutorial, and appointment. Therefore, Interactive Web Based Learning is an ideal system to be used by lecturer and students to facilitate the teaching and learning process.

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1.2 Problems Statement

This system is developed due to realization and concerns of giving better quality education, services and facilities to the students. It is hoped to give more facilities to both students and lecturer during lecture, tutorial, submission of assignment, assessment as well as making appointment via online to overcome manual way of this event.

The problem of manual system are :

I. Students do not have proper and systematic system to obtain their notes assignment questions and even tutorial questions. Thus, this will waste a lot of time to get the materials manually and sometimes the information inside the notes is missing or will be updated by lecturer from times to times. Therefore, it is more effective and systematic to develop the system in order to resolve the problems.

II. Announcement from lecturer has to be made manually and it is inefficient especially in passing the message to the students.

III. General information about the course, lecturer and students is hard to obtain for references.

VI. Students need to submit their assignments and tutorials manually into the lecturer's pigeon hole and it is insecure due to irresponsible action by some people. Besides, lecturer has to spend time to go to collect the works of students from pigeon hole.

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1.3 Project Objectives

The main objective of developing Web Based Learning System is to build an interactive and secure online system to facilitate students and lecturer in the process of teaching and learning during lecture, tutorial, submission of assignment, and even making appointment. Besides, students can do self-paced learning at home through the system. The other objectives of the system are :

I. Facilitate lecturer to make announcements and it is more effective, timeliness and easier to pass the message to all the students. Students also can get the messages faster and more reliable.

II. Facilitate students and lecturer in getting and passing notes as well as tutorials in order to smoothen the learning and teaching process. Students can get their lecture materials earlier before the class starts.

III. Facilitate students in submission of assignments and it is more secure, time-saving and easier for them to submit assignments through the system.

IV. Students can make appointment with lecturer through online system after viewing the schedule prepared by lecturer.

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1.4 Project Scope

Interactive Web-based Learning for Requirement Engineering Course is a system that interacts and deals with target users. The potential users or target users for this system are lecturer (who is teaching Requirement Engineering Course) as well as Faculty of Computer Science and Information Technology students who majoring Software Engineering from University of Malaya. Below are the boundaries of the system that specified to meet the users' needs and facilitate the target users.

I. Teaching materials such as notes, tutorials or assignments will be uploaded by lecturer only. Lecturer can upload any types of files and delete the files when necessary. Meanwhile, students can download and open uploaded files at any time.

II. All the information of students will be inserted, updated, deleted and stored in database by lecturer.

III. Lecturer can also make any important announcement through this system. Apart from that, all the other general information about the course will be provided in this system too.

IV. Lecturer can accept or reject the appointment made by students by sending e-mail to students.

V. Students are provided a file-uploading function to submit their tutorials or assignments into the folder that is created by lecturer. The file-to-be-submit is named according to the students' matrix number.

VI. Students can view the schedules prepared by lecturer and make appointments with lecturer by sending a message using system.

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1.5 Expected Outcome

The expected outcomes of this project are summarized as below :

I. Standard graphic user interface displayed by multiple browsers across all web pages.

II. System transparency. The users of the system will need not to know about the underlying system structure and they just need to utilize this system in their daily work.

III. Acceptable response time when users make request any web page from the web server.

IV. Reliable system with minimum errors while using this system. Data input will be verified before entering database using JavaScript.

V. The database can be scalable to meet more demand and needs that may arise in the future.

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1.6 Project Schedule

Project schedule that consists of the whole development's activities is carefully planned out to achieve consistent progress and to ensure on-time delivery of the product. It is important to have a neat-planned project schedule as it will acts as time management and control the whole process to head for its right directional.

ID	Task Name	Start	Finish	Duration
1	Semester 1	7/8/2004	10/1/2004	62d
2	System Study	7/8/2004	7/21/2004	10d
3	Introduction	7/22/2004	8/5/2004	11d
4	Literature Review	8/3/2004	8/17/2004	11d
5	Methodology	8/16/2004	8/27/2004	10d
6	System Analysis	8/25/2004	9/10/2004	13d
7	System Design	9/13/2004	9/28/2004	12d
8	Semester 2	11/17/2004	2/7/2005	59d
9	System Coding	11/17/2004	1/25/2005	50d
10	System Testing	1/11/2005	1/28/2005	14d
11	System Implementation	1/21/2005	2/4/2005	11d
12	Documentation	7/8/2004	2/4/2005	152d

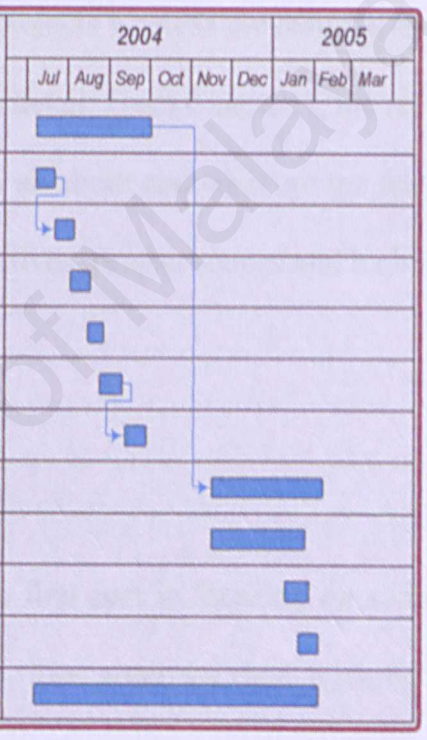

Figure 1.1 : Project Schedule

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1.7 Report Layout

The purpose of this report is to document essential information gathering during system development and implementation stage. The following is brief description of each chapter.

Introduction

Overall, Chapter 1 is an introduction of projects whereas the features and surface of the developed system are explained in detail. From Chapter 1, the readers will be able to understand what the system is all about and what are the features that been carried out such as the project objectives, project scopes and its importance in real life.

Literature Review

Chapter 2 is divided into two parts. The first part is focusing on some similar web based learning system on the web. The good and bad features of these systems are all figured out and discussed. Meanwhile, the second part is describing the techniques that might be used to develop such system.

Methodology

Chapter 3 is focusing more to the steps that involved in the methodology. Each phase of the methodology is explained in details. A brief explanation on the system development approach and design technique also stated in this chapter.

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System Analysis

Chapter 4 describes the gathering process and research strategies that are relevant to the project. It also discusses the functional and non-functional requirement of the system. Tools, software, Operating System and strategy to tackle this project are analyzed and decided in this section.

System Design

Chapter 5 covers the system architecture, system functionality design and database design. Interface designs of this project also proposed at the end of this chapter.

System Implementation

Chapter 6 describes the approaches used in writing codes, scripts languages used to enhance the whole web pages system and algorithms used in implementing the system. Error checking is important as well to make sure that the system runs smoothly and without showing unnecessary error messages.

System Testing

System testing (Chapter 7) is one of the important steps in developing a system. Precision and accuracy of output data is considered during this process. The objective of a system will only achieve after all the thorough testing done by different user with different aspects.

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System Evaluation

Chapter 8 discusses the evaluation techniques that used to evaluate the final system. Besides, system strength and limitation as well as future enhancement also being discussed.

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Chapter 2 : Literature Review

2.1 Domain Studies

The literature related to the research is reviewed in the following section. The focus will be on the system defining, the research and analysis on existing web based learning system. Besides, the proposed system with own ideas with be carried out to exactly mention the features and strengths that system has.

2.1.1 Definition and Terminologies

Interactive

Interactive actually is pertaining to a communications environment in which more than one party is equipped and ready to participate actively in a session or a protocol. Basically, common usage of the term refers to a session where at least one of the parties is human and another of the parties is a software application (Internet Reference, 13/08/2004).

The interaction with the user is usually conducted through either a text-based interface or a graphical user interface. Other kinds of interface, e.g. using speech recognition and/or speech synthesis, are also possible (Internet Reference, 13/08/2004).

Web Based Learning (E-Learning) System

There is a lot of confusion about what web based learning is and how it will impact our lives. Simply said, web based learning is instructional material deployed and managed through computers linked to the Internet.

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E-learning is a term used to signify learning material in an electronic medium. For the purposes of this project, e-learning will represent the specific definition that is "web based learning system" for educational purpose that is directly related to the learning process.

The topic of web based learning is very famous nowadays, even though the concept of e-learning has been around for decades. Web based learning is training that takes place through a network, either over the internet or intranet (Internet Reference, 13/08/2004). In the early 80s, CD-ROM was used to teach mostly technical skills to mostly technical people. But now, the web based learning is widely used in both the corporate and academic worlds.

Many such systems attempts to serve learners interacting with the learning source at different chronological times such as email. E-Learning education is often referred to as those delivery modalities that seek to reduce the barriers of time and space to learning. Thus, they frequently used phrase "anytime, anywhere learning" (Jackson, 2002).

Web Based Learning System In Education

John Chambers, ECO of Cisco Systems, the company most responsible for supplying the electronic plumbing that runs the internet, hails e-learning as "the next big wave in internet-based applications". More recently, Sean Maloney, executive vice president of Intel, proclaimed that e-learning "will be the killer application over the next two to three years". But e-learning will fall far short of its potential if it merely repackages our current educational models in digital format. Instead, it should enable students to become more proficient learners.

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The basic idea is to port the classroom to the Internet in the most efficient way possible. It may be argued that compelling graphics and arresting slide transitions help keep the attention of students in a lecture hall (unless they are sitting in a darkened classroom right after lunch). But if a technology can secure a student's heightened interest in a lecture, does it also enhance his or her ability to learn?

E-Learning gives us the opportunity to change the way we think about and deliver learning solutions. It opens the door to leverage technology in innovative ways that create new learning alternatives. Applications of e-learning include not just web-based learning modules, but online collaboration tools, CD-ROM, satellite broadcast, interactive television, and even videotape.

Though e-learning is not likely to replace traditional learning modalities; in many situations it offers significant advantages over traditional learning modalities such as instructor-led learning, self study using print or video materials, and other training methods. Unlike paper-based materials, e-learning can be interactive, changed constantly and distributed for nominal variable cost.

Interactive Web Based Learning System

Web-based learning can be a flexible and cost-effective alternative to classroom learning, but it can also be a colossal waste of time and money if not implemented correctly. One of the biggest issues facing universities wading into online learning is interactivity, both in its level and mode. How can the instructor make Web-based teaching more interactive? How can the instructor create a virtual classroom environment that maximizes participation? Just what constitutes 'interactivity' is hardly

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clear for some instructors. To some people, it means enabling learners and instructors to share ideas in a virtual chat room; to others, merely posting a question on a bulletin board qualifies as interactivity. Despite the popular conception of the Internet as our most interactive medium, on the great majority of Web-based courses the interaction all goes in one direction. Students' interest, motivation, questioning, and interaction must be on display throughout the learning process (Internet Reference, 14/08/2004).

As the cost of technology decreases, many universities are finding ways to bring the benefits of the classroom into a distance-learning setting. However, distance teaching has been described as an industrialized form of education, characterized by rationalization of process, division of labor and mass production. The new information and communication technologies can facilitate this development, but only if policy makers are sensitive to the opportunities, especially at an international level. Web-based teaching and learning call for a serious reconsideration of the effectiveness (especially in light of increased demand for education and the opportunities for increased student motivation by new technologies) if integrated with knowledge-based design sites. Well-thought instructional design for any Web-based course contributes in moving students' expectations from promises to performance while taking the course (Internet Reference, 14/08/2004).

Web-based learning class is a more effective learning experience, since the learner participates in the learning process and receives individual attention, even when the instructor and the learner are at different locations. This participation in learning is by itself a positive learning experience. The Web-based learning atmosphere allows more effective interaction between the students and instructor. Therefore, it can be as interactive as the traditional classroom learning environment where the space, seating,

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etc., could be inadequate. Online learning teaches students how to think before writing in a disciplined way of communication. It demands discipline of both instructor and student. There is less 'physical touch' but much more intellectual touch.

Interactive Web Based Learning System for Requirement Engineering Course

Interactive Web Based Learning System for Requirement Engineering Course is developed to ease and facilitate the process of teaching and learning among the lecturer and students. Besides, it is essential to build a good relationship between the lecturer and students. These targets can be achieved if the criteria below are fulfilled :

I. The system provides the notes, tutorial questions, and other learning materials through the web site.

II. The system also shows the announcement from lecturer and the general information about the lecturer and Requirement Engineering Course.

III. The system provides the service for students to view the schedules of lecturer. Meanwhile, the students can make appointment by sending message to lecturer via system.

2.1.2 Review of the Existing System

The researches for the existing system about Web Based Learning System have been made. The reviews of the existing system have discovered the advantages and disadvantages of those systems.

The information from the researches is important to overcome and improve the shortages of the current systems. Besides, the references can be used in developing Web Based Learning System for Requirement Engineering Course by maintaining and even

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enhancing the advantages of these systems. Below show the four reviews of the existing systems which have been made :

http://business.cisco.com/prod/tree.taf%3Fasset_id=44748&ID=44748&public_view=true&kbns=1.html

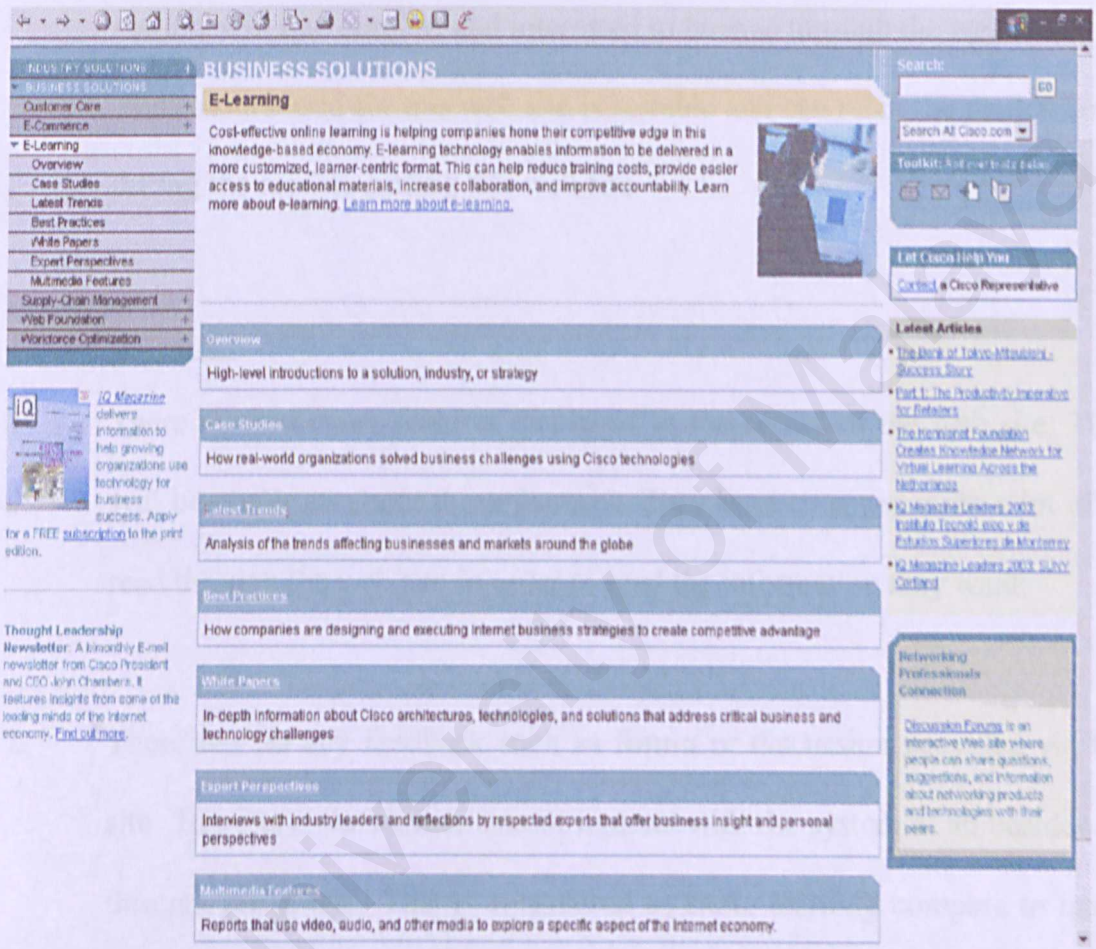

Figure 2.1 : E-Learning System of Cisco Systems

This is the E-Learning web site that is developed by CISCO Systems. The web site distributes the information about the business solutions such as Customer Care and E-Commerce.

Advantages :

1. The information provided to the readers is enough. The readers can get many articles or information related to the topics they want.

2. The articles and materials are grouped according to the topics. In this way, the readers will feel comfort and interested to browse through the web site.

3. The colours used for this web site is suitable and can relax the readers' eye sight during the readers surfing this web site.

Disadvantages :

1. There are too many features displayed at the corner of the web site. The users will be confused about these features. They have to spend quite a lot of time to read through the web site in order to read the information they want.

2. There has no any feedback such as forum or discussion provided via the web site. Therefore, the learner cannot interact with the system at all besides reading through the article. This is considered as static learning compare to interactive learning.

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http://elc.unitar.edu.my/index.php

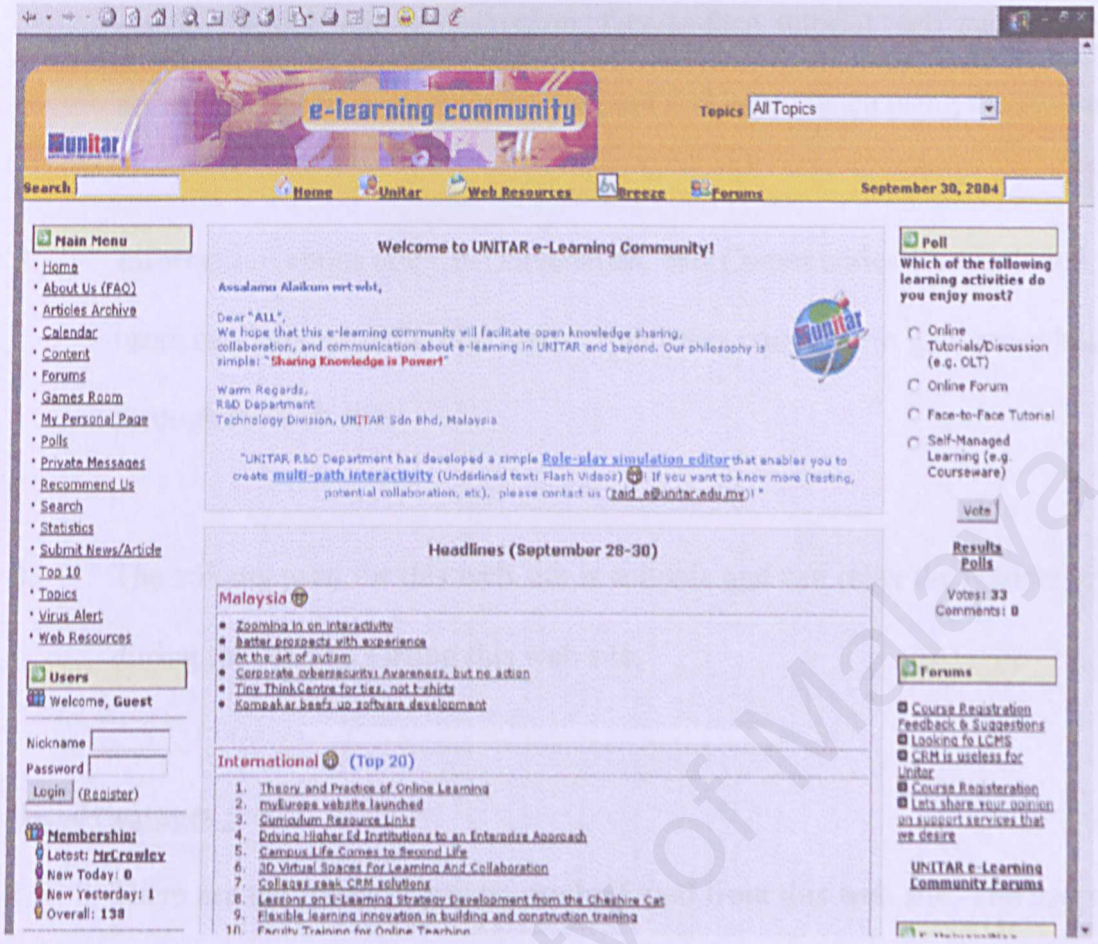

Figure 2.2 : E-Learning Community of UNITAR

This is the web site about UNITAR E-Learning Community that is developed by R&D Department Technology Division, UNITAR Sdn Bhd, Malaysia. This is a good sample or existing e-learning system for system developers who are developing the web based learning system.

Advantages :

1. The site provides a lot of functions such as forum, voting, and so on to users in order to communicate and interact with each other to discuss about certain topic.

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2. Many interesting learning activities can be found through this web site such as online tutorial, online discussion, face-to-face tutorial, self-managed learning and so on. In this way, the users will not feel bored when using the system.

3. Information about other E-Universities, and Communities also included. So, the users can interact with other users from other countries to gain more knowledge through the web site.

4. The colours used for this web site is suitable and can relax the readers' eye sight during the readers surfing this web site.

Disadvantages :

1. There are too many functions can be found from this web site. The users will be confused when browsing this web site because of the over-functionality of this web site. Actually, this is a pro and a con of this web site.

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http://www.unitar.edu.my/elearning/index.html

Figure 2.3 : E-Learning V-Zone of UNITAR

This is the web site about E-Learning V-Zone that is developed by University of Tun Abdul Razak (UNITAR). It is developed to enable the students get the slides, case study and other information through downloading the files.

Advantages :

1. The web site is quite interesting and the colour is very attractive.
2. The features and information on interface is consistent and it makes the users to browse through the web easily.

Disadvantages :

1. There has still a room for improvement and enhancement because there has no any interaction between students and lecturers.

2. The web site does not include the module such as forum, announcement, or even chat room to make the E-learning more effective and interactive.

http://www.niit.com.my/courses.html

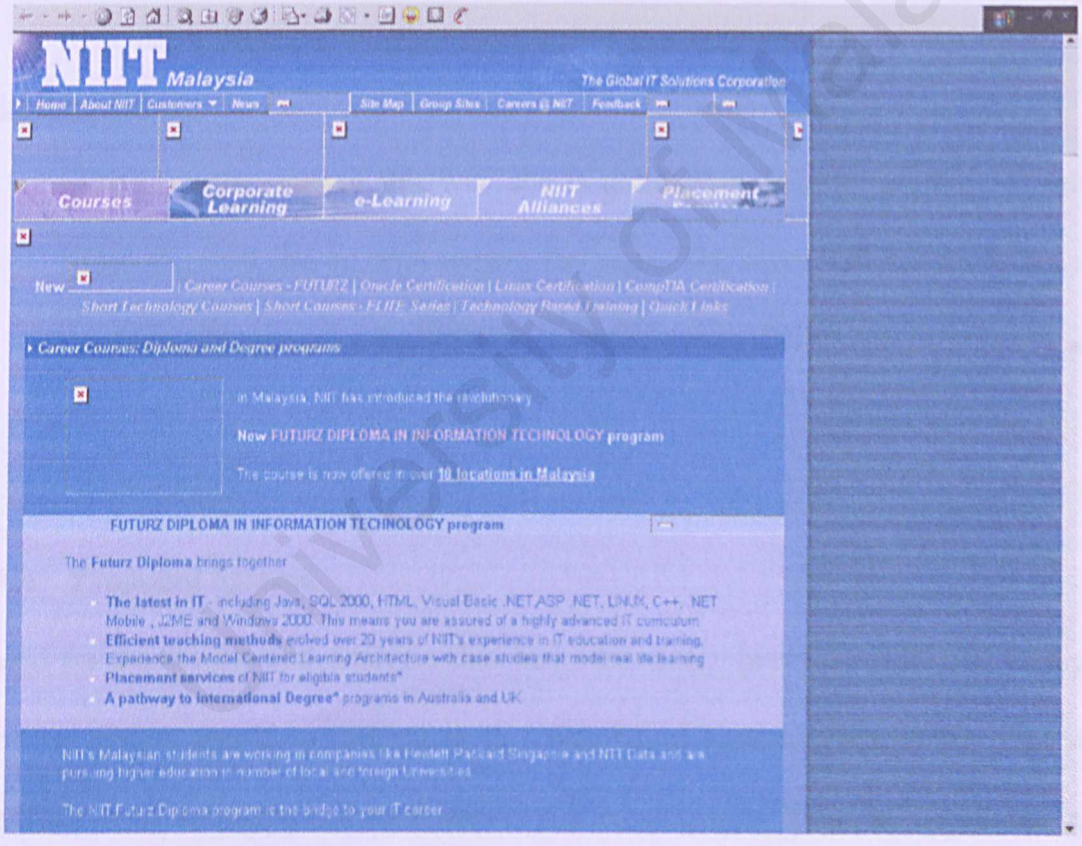

Figure 2.4 : E-Learning Web Site of NIIT

This web site is about the e-learning web site provided by NIIT. NIIT is a global IT services corporation that offers online training, education, multimedia and e-Commerce

software solutions in over 30 countries worldwide. This web site displays a very good sample as E-learning web site.

Advantages:

1. The panel and buttons are designed well and user-friendly. The users or even the new users can easily get used to the system and not be confused.

2. Students can know easily the courses that being provided. Besides, it has module for interaction between students and lecturers or administrators.

Disadvantages :

1. The response time of this web site is quite slow. It takes a plenty of times to open the web site or even refresh the page. The users will get frustrated if this problem always occur during they browse the web site.

2.1.3 Proposed System

Based on the review and analysis that had been done, hence all the weakness of the existing system would not repeat in this web-based system. Though the observation, there are many strengths and weakness in the existing sites. Thus, this proposed system try to solve the problems occur and combine all the strengths to make this site more attractive. Besides, this system also enhances some new features to make this web site easy to use and user friendly. Below are the features of the proposed system :

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I. Web –based System

This proposed system is a web-based system. It does ensure the accessibility of the Internet users. User with all kind of Operating System and web browser such as Internet Explorer or Netscape Communicator is able to access this web site.

II. Online Application

This system is a type of online application, therefore all the published information is the latest one. In addition, administration can be made easily via online application. Moreover, this system is a self-maintained system. Without passing the upload document to administrator, users are able to upload document to this site themselves.

III. Time-Saving

The system also supports the appointment features. This is important to enable the students to make appointment with lecturer without seeing lecturer personally. Making appointment via online system sure will save plenty of time by typing a message and clicking a few buttons. That is an advanced way to make sure that the system can provide interactive and even effective learning to students.

IV. Database

The proposed system is using database to store and retrieve data efficiently.

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V. **Organizes A Good Menu**

Main menu is resided in a panel so that it can be act as a navigator for visitors while they are browsing this web site. It is good to make sure that all the links are consistent and are resided in every page. Visitors may not lose themselves if the menu and the link are organized based on user friendly.

2.2 Technology Review

For this development of Web-based Learning System, literature review has been carried out on the system requirements for this system as well as materials and information that will enhance the development of this system which includes :

I. Operating System

II. Web Server

III. Web Database

IV. Web Application Programming Language

V. Web Browser

VI. Web Editor Tool

2.2.1 Operating System

2.2.1.1 Unix

UNIX is one of the most popular operating systems worldwide because of its large support based on distribution. It was originally developed as a multitasking system for minicomputers and mainframes in the mid-1970s, but it has since grown to become one of the most widely used operating systems anywhere. But, it sometimes has confusing interface and lack of central standardization.

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Unix is multitasking, multi-user operating system. This means that there can be many people using one computer at the same time, running many different applications (This differs from MS-DOS, where only one person can use the system at any one time).

Under Unix, the users must log in to identify themselves to the system, which entails two steps: Entering user's login name (the name by which the system identifies the user), and entering his / her password. No one else can log in to the system under his / her username without knowing the password.

In addition, each Unix system has a hostname assigned to it. It is hostname that gives the machine a name, gives it character, class and charm. The hostname is used to identify individual machines on a network, but even if the machine isn't networked, it should have a hostname.

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2.2.1.2 LINUX

LINUX is free and work-alike designed for Intel processors on personal computer architecture machines. Linux is not Unix, as Unix is a copyright piece of software that demands licenses fees when any part of its source code is used. Linux was written from scratch to avoid license fees entirely, although the operation of the Linux operating system is based on Unix and it shares Unix's command set.

Linux supports a wide range of software from TeX (a text formatting language) to X (a graphical user interface) to the GNU C/C – compilers to TCP/IP networking.

Here are some of the important features of Linux that make it so unique :

I. Full Multitasking and 32-Bit Support

Linux is a real multitasking system that allows multiple users to run many programs on the same system at once. Linux is also a full 32-bit operating system that utilizes the special protected-mode features of Intel 80386 and later processors and their work-alike.

II. The X Window System

The X Window System is a very powerful graphic interface, supporting many applications. A complete version of the X Window System, known as Xfree86, is available for Linux. This means Linux is moving into the GUI world in the future.

III. Bulit-in Networking Support

Linux uses standard TCP/IP protocols, including Network File System (NFS) and Network Information Service (NIS, formerly known as YP). By connecting the system with an Ethernet card or over a modem to another system, anyone can access the Internet.

IV. Linux is fault-tolerant

It is used to more than 31% of the world's web servers. With Apache as the primary application for these servers, they have proven to be practically immune to the recent explosion of viruses that have plagued e-mail and the Internet.

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V. Security

Because of the available source code and the ability for users to modify, Linux is not as secure as other system if an ever-expanding group of hackers who want to get their hands dirty with others' Linux -based system.

VI. Lower Cost Than Most Other Windows NT Systems and UNIX Clones Systems

Anyone who has the patience to access to the Internet, the only price that needs to pay for Linux is the time. Linux is freely available on the Internet. For a nominal fee of anywhere from US$30 to US$90, anyone who wish to use Linux can save their time by getting CD-ROM or floppy disk distributions from several commercial vendors.

2.2.1.3 Windows XP Professional

Windows XP Professional is designed from the ground up to be the most integrated, comprehensive and easy server operating system. It provides total solutions in Intranet and Internet services and to mission-critical applications support. All these services are built into operating system.

Besides, it has fault tolerant features by supporting Redundant Array of Inexpensive Disks (RAID) technology that provides data protection. This can help prevent web server from easily crash due to hard disk failure. Furthermore, right integration of Internet Information Server (IIS) with Windows XP Professional provides a fast and secure platform for HTTP, FTP, WWW and Gopher Services.

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Windows XP Professional also provides an outstanding platform for a wide range of services and applications and to be a superb, high-performance, high-availability network operating system. It also includes features designed to make it easier to install, use and manage than ever before.

Windows XP Professional also includes a Web-based administration tool that makes the features of the Windows XP administrative tool suite available through any Web browser. For security, a Web browser that supports either direct Windows XP log-in (such as Internet Explorer) or one that supports Secure Socket Layers (SSL) communication is used. The following table describes the features and benefits of Windows XP Professional :

Table 2.1 : The features and Benefits of Windows XP Professional

Feature	Benefit
Hardware Support	(a) Supports Universal Serial Bus (USB), an external bus standard that eliminates many constraints of earlier computer peripherals. (b) Supports Plug and Play hardware, which Windows XP automatically detects, installs, and configures.
Networking and Communication Services	(a) Provides built-in support for the most popular network protocols, including TCP/IP and IPX/SPX. (b) Provides connectivity with Novell Netware,

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	UNIX, and AppleTalk.
Internet Integration	(a) Integrates users' desktops with the Internet, thereby removing the distinction between the local computer and the Internet. Users can securely browse the network, Intranet, and Internet for resources, as well as send and receive e-mail messages. (b) Windows XP Professional includes Microsoft Internet Information Server (IIS), which is a secure web server platform used to host Internet and Intranet web sites on network servers.
Security	(a) Authenticates users before they gain access to resources or data on a computer or the network. (b) Provides local and network security and auditing for files, folders, printers, and other resources. (c) Supports the Kerberos protocol and Public Key Infrastructure (PKI) security.
Integrated Administration Tools	(a) Provides the means to create customized tools to manage local and remote computers with a single standard interface. (b) Provides the means to incorporate third-party administrative tools into the standard interface.

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Table 2.2 : Comparison Between LINUX, UNIX and Windows XP

Features	Linux	UNIX	Windows XP
Compatibility with Web Development Tools	Less compatible with development tools because it does not offer much development tools.	Incompatible with Web development tools because it does not offer much development tools.	Compatible with Web development tools because it offers many development tools.
Cost Effective	Cost effective because it is freeware.	Not cost effective because the whole operating system need to be recompiled with certain modification.	Cost effective OS, a fully functional Internet Server is running in matter of days.
Security	Vulnerability is high because distribution of source code is widely available.	Vulnerability is high because distribution of source code is widely available.	Vulnerability is low because most of the applications are not truly available in Internet.

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The functionality of Personal Web Server :

I. Allows webs to be published as a whole, with a single command.

II. Publish from local to remote, remote to local, or remote to remote web sites.

III. Provides the functionality of CGI, ASP, ISAPI programs, and the FrontPage WebBots on the local computer, so that the developer can test the webs locally in the browser before making them public. All of these technologies require a server and / or FrontPage server extensions to run.

IV. Set permissions and properties of webs and folders. FrontPage communicates with the server to do this. Especially important if the developer uses interactive technology, such as CGI, IDC, or ASP.

V. Sets up virtual directories on the server.

2.2.2.2 Microsoft Internet Information Server (IIS) 6.0

Microsoft Internet Information Server (IIS) is a comprehensive solution that comes with Active Server Pages (ASP) for building dynamic Web pages. On top of that, IIS is free as it can be downloaded from Microsoft's Web sites or with the purchase of its required operating system.

IIS's tight integration with Windows XP is immediately apparent and provides a transactional-based Web server. IIS uses Windows XP's User Manager to maintain users and groups, saving the trouble of maintaining multiple sets of network and Web site users.

The transactional ASP of IIS provides an extensive server-side platform supporting compile free, language independent scripts and ActiveX components. This, coupled

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with the fact that IIS returns all ASP requests as standard HTML, lets the developer create truly dynamic Web sites and online applications accessible by any browser. And yes, IIS now fully support Java through a Java virtual machine. Database access has also been extended in this version of IIS.

ActiveX Data Objects (ADO), an ASP component, lets developer access and control data in any ODBC compliant database using any ActiveX scripting language. Developer can put a Web front end on almost any legacy database without arcane CGI programming. To tap into the power of ASP and server-side scripting, IIS includes native scripting engines for VBScript and Jscript. Server plug-ins is available for other scripting languages such as Perl. The developer can even use several different scripting languages within a single ASP document.

2.2.3 Web Database

2.2.3.1 Microsoft SQL Server 2005

Microsoft SQL Server is a significant tool in many regards, from data warehousing to application that require not only a large amount of information but also many different simultaneous users. It is also a key component in answering data management requirements and a powerful as well as comprehensive database.

Microsoft SQL Server is the compact database for rapidly developing applications that extend enterprise data management capabilities to devices. It is also a perfect example of an N-tier system. The users can manipulate the data directly from the client side. Most of the time, the data is validated first before it is updated into the database in server side.

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It is tightly integrated with Microsoft BackOffice family products as well to enable organization to improve decision making and streamline the business process. Besides, SQL Server maintains referential integrity and security and ensures that operation can be recovered in the event of numerous types of failure. It can control the access for the type of information that can be retrieved by the user.

Other than that, it supports Internet database integration. It allows the user to automate the publishing of database information in HTML documents and allows all to build active Web sites as well as letting us to conduct processes on the Internet.

When combining the IIS with the SQL Server Internet Connector, it gives users the complete Internet database publishing capabilities. It also provides the function for transparent distributed transactions. This means that it provides automatic distributed update capability across two or more SQL Server transparent to desktop application, making it simple to use and guarantees the integrity of transaction of spanning multiple servers.

2.2.3.2 Microsoft Access

Windows-based database management system that can runs under Windows 95/98/NT operating system. It can be viewed as a large repository in which tables, reports, queries, and other objects are stored. The Microsoft Access package is one of the best selling relational database packages for Windows on the market. It is estimated that currently more than 10 millions people using this database package.

Access provides an inexpensive yet powerful database solution for small-scale projects and yet easy to use. With Access, databases can be designed or created very quickly

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whether simple or complex to create tables, forms, queries and reports. To make the task even simpler, Access comes with a set of wizards. All we need to do is answering a few questions and Access will do the rest for us.

Besides, Access also allows users to indicate how tables should be related to each other. A table can has referential integrity that allows only one parent record for each child record. Access allows users to make changes to the structure of a database table. User can add, delete and rearrange fields in the table structure.

Access also provides a set of tools to customize applications besides letting us to share the information with other applications such as Microsoft Word and Microsoft Excel. In short, Access is designed to meet even the most exacting personal or organization's database needs.

2.2.4 Web Application Programming Language

2.2.4.1 ASP.NET (Active Server Pages)

ASP.NET is a Microsoft technology, and it works by allowing the functionality of a programming language; programming code can be written so that it will generate the HTML for the web dynamically.

ASP.NET are server generated pages, which can call other programs to do things like access databases, serve different pages to different browsers and basically anything we used to do with Common Gateway Interface (CGI). It solves all the problems associated with CGI and server APIs to communicate with other applications running on the server.

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ASP.NET is also almost as efficient as writing code directly to the server's application program interface and it is a lot more efficient than CGI because it runs as a service and can take advantage of multithreaded architectures.

With ASP.NET, it is simple to write the code in the HTML page itself. The HTML tags and the code are side by side. Codes are written in a simple scripting language that is easy to learn and easy to use. Then the page is saved to the Web site and it is ready to go. There is no compiling and no complex interfacing.

ASP.NET is an open, compile free application environment in which it can combine HTML, scripts and reusable ActiveX server components to create dynamic and powerful Web-based business solutions. As imagine, ASP.NET makes it much quicker and easier to create highly interactive Web sites. It also makes pages easier to maintain and update in the future. It is a feature built into a different piece of software. For A Microsoft Internet Information Server or a Personal Web Server is needed for ASP.

2.2.4.2 Java Server Pages (JSP)

Java Server Pages is a new technology that allows the user to combine markup (HTML or XML) with Java code to dynamically generate web pages. The JSP specification is implemented by several web servers, and plug-ins are available that allow the user to use. JSP supports the same modularity, reusability, platform-independence and access to Java APIs that Java programming supports. This provides developers great advantages to rapidly develop and easily maintain information-rich, dynamic web pages in Java in a more relaxed, script-like environment.

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2.2.4.3 Personal Home Page (PHP) 5.0

PHP is a widely-used general-purpose scripting language that is especially suited for Web development and can be embedded into HTML. PHP is a server-side HTML-embedded scripting language.

Below are the advantages of PHP 5.0 :

- PHP 5 is an open source and free.
- It is cross platform and compatible with most of the web server.
- PHP 5 is easy to learn.
- PHP 5 is object-oriented and it enables users to build classes and custom objects.
- PHP 5 is interpreted and it is embedded with HTML. Hence, it does not need to be compiled into binary code before they can be tested or used.

2.2.5 Web Browser

Web browser is a software package that enables a user to display and interact with HTML documents hosted by web server. It is the most commonly used kind of user agent. Technically, a Web browser is a client program that uses the Hypertext Transfer Protocol (HTTP) to make requests of Web servers throughout the Internet on behalf of the browser user. Some of the available popular web browsers are shown as follow:

2.2.5.1 Internet Explorer 6.0

Internet Explorer 6.0 is a set of core technologies in Microsoft operating systems that provides enhanced privacy features and a flexible and reliable browsing experience for users of Windows XP, Windows Millennium Edition (Windows Me), Windows 2000, Windows 98, and Windows NT® 4.0 with Service Pack 6a or later.

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Below are the advantages of Internet Explorer 6.0:

- IE6 has good support for XML and XHTML.
- IE comes with a lot of plug-in ready installed.
- Fault collection services of IE 6.0 help identify potential problems that need to be fixed in future Internet Explorer Service Packs.

2.2.5.2 Netscape 7.2

Netscape has updated its Internet suite to version 7.2. This new version offers many improvements since the previous release, including improved standards support and better control over popup windows. It is derived from Mozilla 1.7.

Below are the advantages of Netscape 7.2:

- Improvements in standards support.
- Improvements in browser rendering speed and application start-up.
- New Macromedia® Flash 7 plug-in for Windows.
- Popup Window Controls have been improved to block mouse over pop-ups and limit the number of pop-ups when popup window controls preference is set to off.

2.2.6 Web Editor Tool

Web editor tool is a software application used to create multimedia content typically for delivery on the World Wide Web.

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2.2.6.1 Microsoft FrontPage 2003

Microsoft FrontPage 2003 provides the features, flexibility, and functionality to help to build better Web sites. It includes the professional design, authoring, data, and publishing tools needed to create dynamic and sophisticated Web sites.

Below are the advantages of Microsoft FrontPage 2003:

- Design better-looking sites.
- Generate code faster and easier.
- Extend the Power and Reach of the Web Site.

2.2.6.2 Dreamweaver MX

Dreamweaver MX is the latest release from the Macromedia and it has some significant improvements over version 4. It delivers a complete set of tools for creating and managing any professional web site. This powerful development solution combines renowned visual layout tools of Dreamweaver, the rapid web application features of Dreamweaver UltraDev, and the extensive code editing support of HomeSite in one integrated package.

Below are the advantages of Microsoft FrontPage 2003:

- It is a powerful tool to create, build and manage websites.
- Built-in reference guides.
- Site setup wizard helps to configure site information instantly.
- Provide the ability to work on multiple sites.
- Integrated workspace shared with Flash MX and Fireworks MX.

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- Code validator and built-in validating mechanisms make it easy to check a page.

2.2.6.3 Microsoft Visual Studio .NET 2003

Visual Studio .NET is the only development environment built from the ground up to enable integration through XML Web services. By allowing applications to share data over the Internet, XML Web services enable developers to assemble applications from new and existing code, regardless of platform, programming language, or object model.

Visual Studio .NET 2003 Professional enables rapidly build a broad range of applications for Microsoft Windows®, the Web, and devices. With intuitive visual designers, high-performance data access tools, server-side visual designers, native support for the Microsoft .NET Compact Framework, and inherent support for XML Web services, Visual Studio .NET 2003 Professional delivers improved reliability, security, and performance.

Visual Studio .NET 2003 enables you to address today's most pressing application development and deployment challenges, streamline business processes, and realize new business opportunities. The unified Visual Studio .NET 2003 integrated development environment (IDE) and a choice of programming languages—including Microsoft Visual Basic® .NET 2003, Microsoft Visual C++® .NET 2003, Microsoft Visual C#® .NET 2003, and Microsoft Visual J#™ .NET 2003—enable developer to build professional applications .

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Chapter 3 : Methodology

3.1 Software Development Life Cycle

In talking a systematic approach to systems analysis and design, there have a few popular choices. The most popular development model is Software Development Life Cycle (SDLC). Software Development Life cycle is a phased approach to analysis and design, which holds that system is best developed through the use of a specific cycle of analyst and user activities. This model was basically derived from other established engineering process. This model also offers a means of making the development model more visible.

Determination of phase in SDLC is not predetermined prior of usage. Its composition of processes depends on the individual system analyst's view and experience. The proposed phase should typically be divided into nine distinct but interrelated phases. The phases are :

I. Scope Definition.

II. Problem Analysis.

III. Requirement Analysis.

IV. Logical Design.

V. Decision Analysis.

VI. Physical Design and Integration.

VII. Construction and Design.

VIII. Installation and Delivery.

IX. System Operation and Maintenance.

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As it is mentioned, there are tremendous variations to the process model, but this basic model mapped the fundamental development activities. In practical, these phrases overlap and feed information to one another. Therefore, the model does not depict a linear sequence of processes but interaction of the development activities. This model is known as the "Waterfall" model as well because of the characteristic.

3.2 Methodology Consideration

A methodology is a problem solving approach to build systems. A System Development Methodology is a very formal and precise system development process that defines a set of activities, methods, best practices, deliverables and automated tools for system developers to use to develop and maintain most or all information system and software.

Therefore, any methodology chosen for Web-based Learning System will ensure that a consistent and reproducible approach is applied to this project. Methodology will also reduce the risk associated with shortcuts and mistakes as well as produces a complete and consistent documentation.

Methodology enables one to follow a certain procedures, where its basis is laid down in the way a problem is encountered. Methodology is also flexible enough to provide for different types of projects and strategies. In general, a methodology should fulfill two basic requirements :

I. Effective Support of Design Process

- Provide the means to identify the different steps in the system development process. It involved from system logic reasoning, semantic

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modeling towards syntax specification.

- Provide the means to set boundaries to system environment. It is required to set boundaries and to take relevant aspects into consideration.

- The methodology should support stepwise refinement of an immediate consequence of the previous requirement in the design process. The concept of decomposition of a total system into subsystems is required in order to reduce complexity.

II. Efficient Control of Project

- Provide tools to an efficient control of a project. Most of the time, a methodology uses the well-known concepts of activity planning, deliverable and milestone definition in the different stages of a system development project, no matter how it applies to the design phase or the implementation phase.

3.2.1 Design Technique Consideration

Let us review some information of two design techniques which are used in design phase when developing a software product. These two techniques are :

I. Structured Design

II. Object Oriented Design (OOD)

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3.2.1.1 Structured Design

By using a structured design methodology, the likelihood of finding design flaws early improves considerably. Finding design flaws early in the design process greatly reduces the cost of fixing those flaws.

Structured design methods also improve the ability to modify and maintain programs since the techniques make the production of clear and complete documentation much easier. Structured designs can also be more easily broken up into modules to improve testing and to allow development by multiple design teams with a reasonable assurance that the resulting products will be compatible with each other.

Some projects implemented in embedded control, however, usually require much less code and thus need an appropriate design level. The technique that structured design uses in this class is one of top/down, structured flowcharts.

Top/down design begins with an overall problem description. The main elements required to implement this design become the processes in the top-level flowchart. The processes at the top level are then broken down into greater detail in lower-level flowcharts. The flowcharting is complete when the process descriptions are sufficiently simple that no further breakdown can be done except to write the instruction(s) for the operation described.

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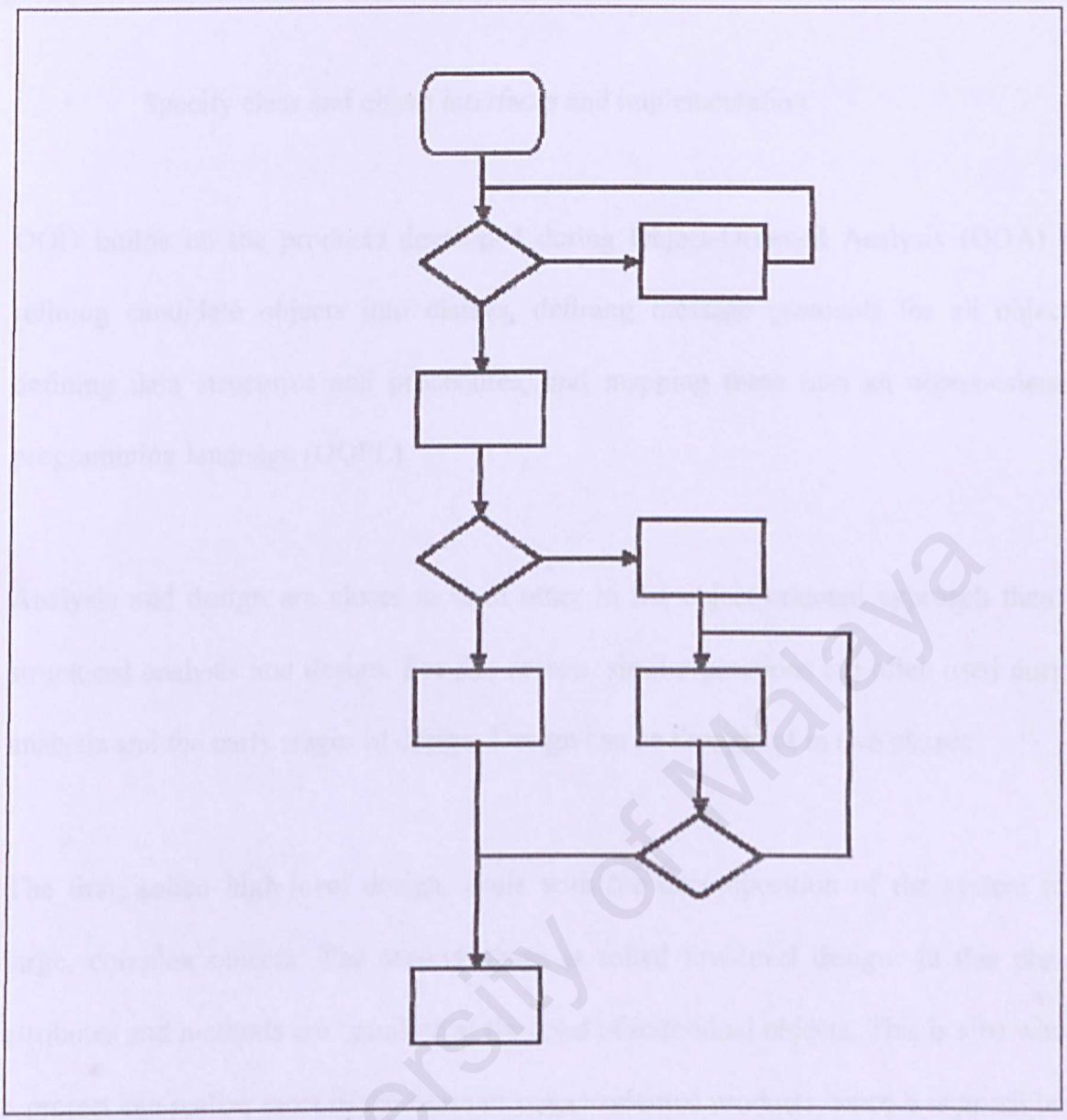

Figure 3.1 : Eample of Sturctured Flowchart

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3.2.1.2 Object Oriented Design (OOD)

Object Oriented Design is a design method in which a system is modeled as a collection of cooperating objects and individual objects are treated as instances of a class within a class hierarchy. Four stages can be identified:

- Identify the classes and objects
- Identify their semantics
- Identify their relationships

- Specify class and object interfaces and implementation

OOD builds on the products developed during Object-Oriented Analysis (OOA) by refining candidate objects into classes, defining message protocols for all objects, defining data structures and procedures, and mapping these into an object-oriented programming language (OOPL).

Analysis and design are closer to each other in the object-oriented approach than in structured analysis and design. For this reason, similar notations are often used during analysis and the early stages of design. Design can be thought of in two phases.

The first, called high-level design, deals with the decomposition of the system into large, complex objects. The second phase is called low-level design. In this phase, attributes and methods are specified at the level of individual objects. This is also where a project can realize most of the reuse of object-oriented products, since it is possible to guide the design so that lower-level objects correspond exactly to those in existing object libraries or to develop objects with reuse potential. As in OOA, the OOD artifacts are represented using CASE tools with object-oriented terminology.

3.2.1.3 Design Technique Used

In this project, Object Oriented Design is used as the design technique for the system development. OOD is a popular technique that used by large organizations to develop the software product using object oriented languages such as C++, SmallTalk, and Java. Although OOD as such is not supported by classical languages (C, COBOL, and FONTRAN), a large subset of OOD can be used.

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Besides, OOD is used in order to enhance key software quality factors of a system and its constituent components. It means that OOD techniques enhance key external and internal software quality factors, which are :

I. External (Visible to end-users)

- Correctness
- Robustness and reliability
- Performance

II. Internal (Visible to developers)

- Modularity
- Flexibility / Extensibility
- Reusability
- Compatibility (via standard / uniform interfaces)

3.2.2 Methodology Used

Unified Software Development Process or just called Unified Process (UP) is an object-oriented methodology that adopted in the development of Web Based Learning System for Requirement Engineering Course.

UP is characterized by 3 primary elements that can bring a success to the software development :

I. Use-case driven

- Functional requirements are captured as instructions to a black box.

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II. Architecture Centric

- The environment, tools, and components available are used to avoid reinventing what already exists.

III. Incremental and Iterative

- Instead of mandating perfection, the process uses continual iteration to achieve refined excellence.

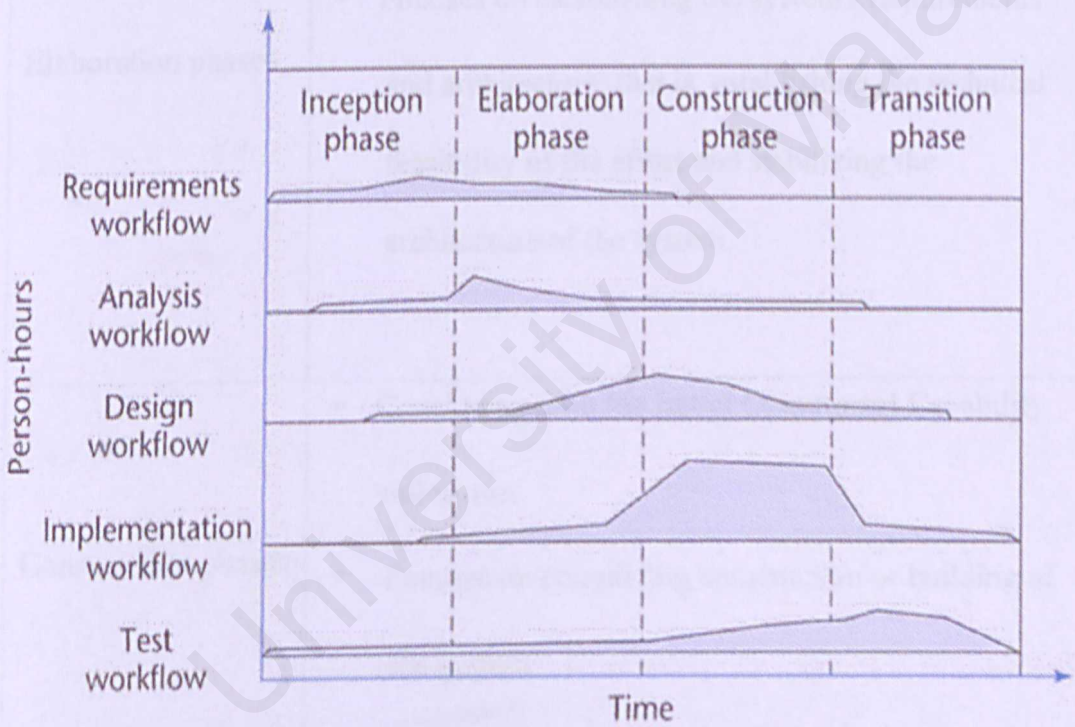

Figure 3.2 : The Core Workflows and the Phases of the Unified Process

The figure 3.2 above shows the workflows and phases of the UP. Within the Unified Process, each cycle contains four phases which are described in table below :

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Table 3.1 : Four Phases of the Unified Process

Phases	Goal
Inception phases	• Concluding with the project objective milestone. • Focuses on establishing the project's scope and vision; that is, establishing the system feasibility of the effort and stabilizing the objectives of the project.
Elaboration phases	• Concluding with the architecture milestone. • Focuses on establishing the system's requirements and architecture; that is, establishing the technical feasibility of the effort and stabilizing the architecture of the system.
Construction phases	• Concluding with the Initial Operational Capability milestone. • Focuses on completing construction or building of the system.
Transition phases	• Concluding with the Product Release milestone. • Focuses on completing transitioning or deployment of the system to the user community.

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Within Unified Process, six workflows cut across the set of four phases. Each workflow is a set of activities that performed by project developers. The five workflows are:

- Requirements workflow
- Analysis workflow
- Design workflow
- Implementation workflow
- Test workflow

Within each phase are a number of iterations. Iteration represents a complete development cycle, from requirements capture in analysis to implementation and testing that result in the release of an executable project.

3.3 Research Methodology

Effective and appropriate techniques must be used to define and elicit user's requirements. Research methods that usually used are information gathering and research of existing system.

Below are the description of the research methodologies which are used to gather the information and requirements to develop Interactive Web Based Learning for Requirement Engineering Course :

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3.3.1 Information Gathering

Information gathering can be divided into many methods such as library research, internet surfing, suggestion or discussion with lecturer, and collecting information from past year thesis.

3.3.1.1 Library Research

Library is one of the good resources in order to develop this system. It is important to search books related to e-learning and how does an online system can be implemented effectively and interactively?

3.3.1.2 Internet Surfing

Resources from Internet are the best way to find out the strengths and weakness of the existing systems in order to gain deeper understanding about the development of the web based learning system.

3.3.1.3 Suggestion or Discussion with Lecturer

Lecturer is a good leader or guider for the effectiveness and success of the system. There are many ideas and good suggestion can be gained from lecturer because lecturer is one of the users of the system. Through the consultation, the exact requirements that should be included in the system can be known easily.

3.3.1.4 Collecting Information from Past Year Thesis

There are many thesis with familiar system can be found as the references. Through these resources, many useful information and knowledge can be gained.

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3.3.2 Research of Existing System

The information from the researches of existing Web Based Learning System is needed to overcome the shortages of the current systems. In this way, the disadvantages of the existing system can be improved and reused in Web Based Learning System for Requirement Engineering Course. Besides, the pros or advantages of the current system can be reused too or even enhanced in the system in order to develop a better system. Some information of the existing system can be found in Chapter 2.

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Chapter 4 : System Analysis

4.1 System Requirement Analysis

System analysis is focusing on determining the user's needs and requirements as well as studies the application in depth. Actually every system is built and developed in order to meet some set of needs. The needs can be varied. For instance, the need of the organization for the lower operational costs, the need of more systematic and better information management, the need for smoother operations or the need of customers for better level of services. All these needs will later give an idea for the system developer on how does the system or application should be built so that it can satisfies the requirements from different level of users.

For this Web based Learning Project, the purposes of analysis phase are :

1. To acquire knowledge on how does the Web Based Learning System for Requirements Engineering Course should work.
2. Research on how this system can be developed using current or maybe latest new emerging technologies.
3. To gain an overall understanding of system data flow and system process.
4. To identify the major components that will need to be included in the system.
5. To analyze and plan control features to develop a robust and reliable system.

4.1.1 Functional Requirements

4.1.1.1 Functional Requirements Description

Lecturer's Module

1. Lecturer must log in to system before begin any process. The system should allow lecturer to upload teaching materials such as notes, tutorials or

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assignments. Besides, the system should also allow the lecturer to delete the files when necessary.

2. The system should allow lecturer records marks of each assignment including test for student. After lecturer enters the marks, system needs to validate the marks entered to ensure it is in correct range, and display the result of each student to lecturer after lecturer saves the marks for students. The system should display the summary of the students' results in graphic (bar chart) when the lecturer requests it.

3. The lecturer is allowed to make announcement on the web site after he / she logs in to the system.

4. The system should also allow the lecturer to add the information of the new student to database or delete it.

5. The lecturer is allowed to download the submission files from student such as assignment or tutorial after the lecturer log in to the system.

6. The system should allow lecturer and student enter the forum and chat room after they log in to the system. Besides, the system should allow lecturer to give warning or even ban certain student from entering the forum if the student is found to post the message that is not related to the course.

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Student's Module

1. Every student is allowed to update or change his/her own information after log in to the system. The system should record the last update time and date into database if there has any changes is done by the student.

2. The system should allow each student who is authorized to use the system to download the teaching materials from the web site.

3. Each student is allowed to submit or upload the files such as assignment or tutorial to the system after log in to the system.

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4.1.1.1.1 Use Case Diagram

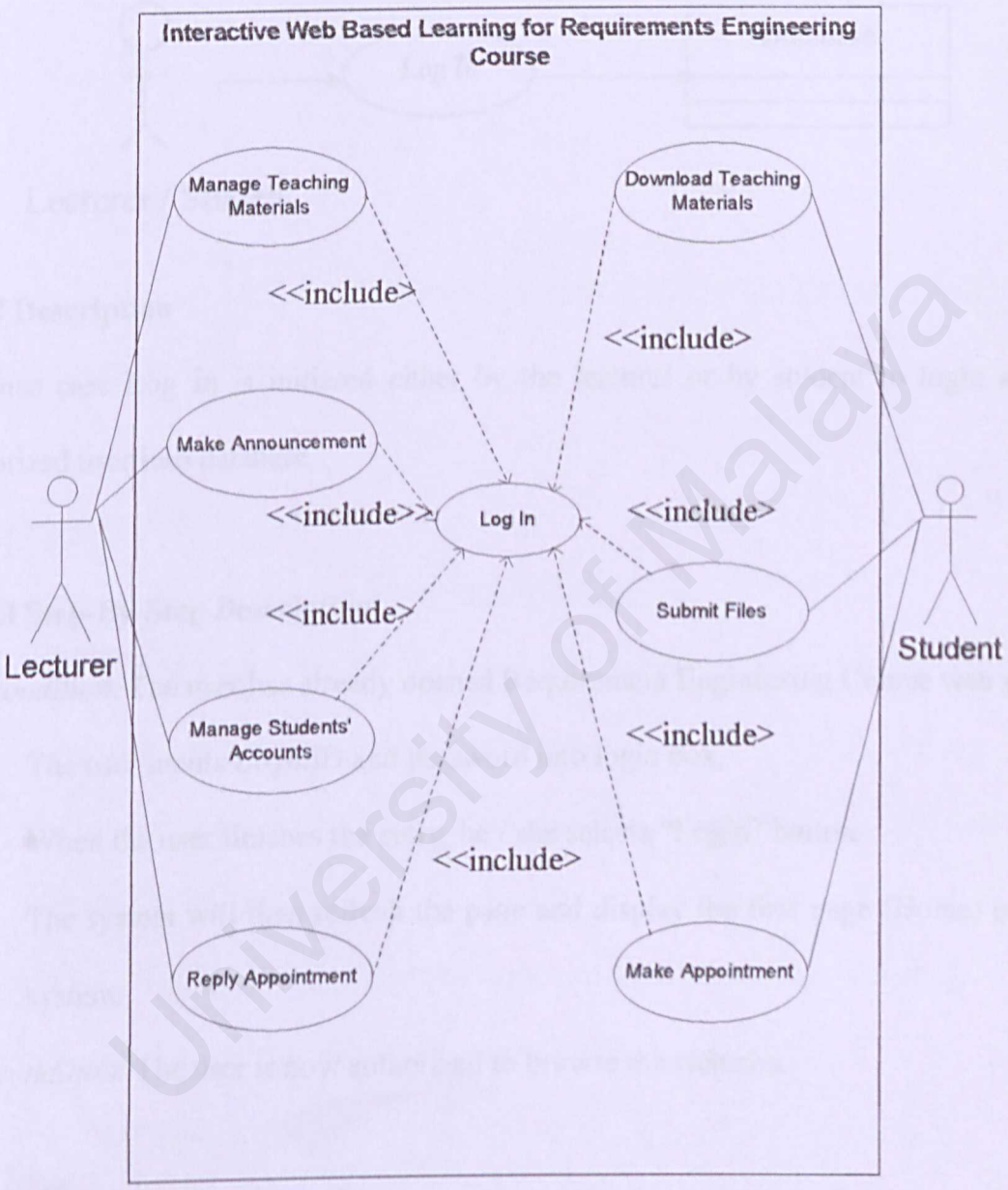

Figure 4.1 : Use Case Diagram of Interactive Web Based Learning System for Requirement Engineering Course

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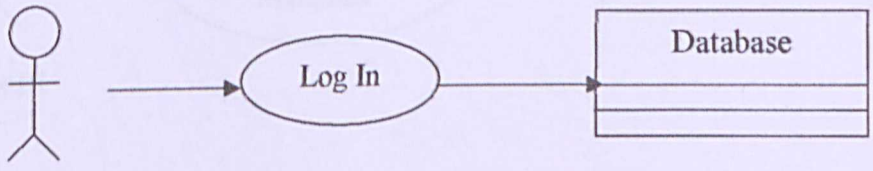
4.1.1.2 Functional Requirements Definiton

4.1.1.2.1 Log In



Lecturer / Student

Brief Description

The use case Log In is initiated either by the lecturer or by student to login as an authorized user into database.

Initial Step-By-Step Description

Pre-condition: The user has already opened Requirement Engineering Course web site.

1. The user inputs LoginID and password into login box.
2. When the user finishes the entry, he / she selects "Login" button.
3. The system will then refresh the page and display the first page (Home) of the system.

Post-condition: The user is now authorized to browse the web site.

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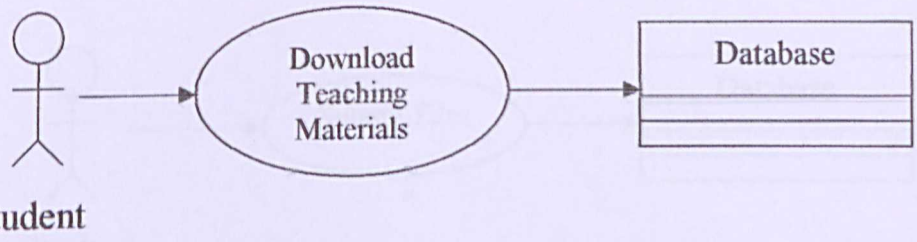
4.1.1.2.2 Download Teaching Materials



Brief Description

The use case Download Teaching Materials is initiated by the student to download the teaching materials from database.

Initial Step-By-Step Description

Pre-condition: The student has already logged into system.

1. The student clicks on the instructions ("Lecture Note", "Tutorial", "Others, "Appointment") from main page of the web site.
2. The system refreshes the page and displays the page according to the download instruction clicked.
3. The student clicks on the links of the files that he/she wants to download.
4. The system will download the files requested from database.

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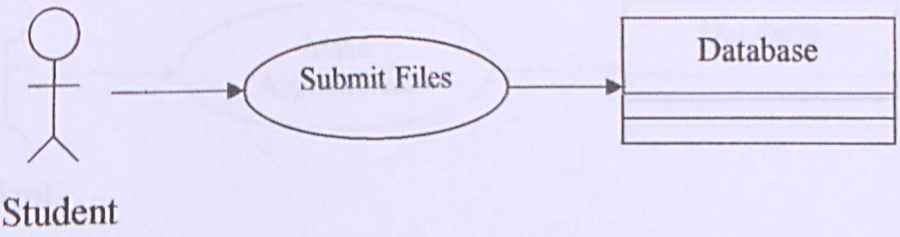
4.1.1.2.3 Submit Files



Brief Description

The use case Submit Files is initiated by the student to submit or upload his/her files into database.

Initial Step-By-Step Description

Pre-condition: The student has already logged into the system.

1. The student clicks on the "Submission" from main page of the web site.
2. The student selects the file he/she wants to submit. Meanwhile, he/she can select the folder from dropdown list to determine which folder he/she wants to download to. Then, the student clicks "Submit" after entering the matrix number.
3. The system will upload the file into database.

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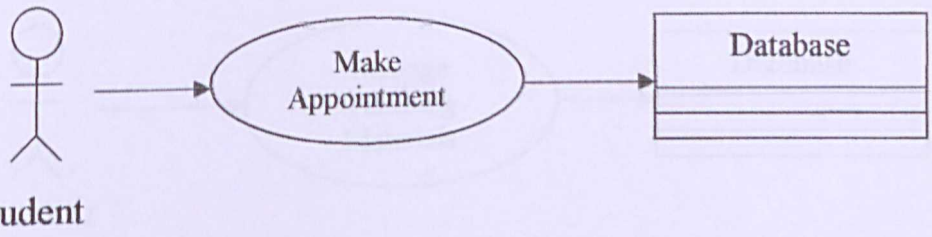
4.1.1.2.4 Make Appointment



Brief Description

The use case Make Appointment is initiated by the student to make appointment with lecturer on the web site.

Initial Step-By-Step Description

Pre-condition: Student has already logged into the system.

1. Students click on the "Announcement" from the main page.
2. The system refreshes the page.
3. Students then enter the details in each field required before click "Send" button.
4. The system then uploads the appointment details into database.

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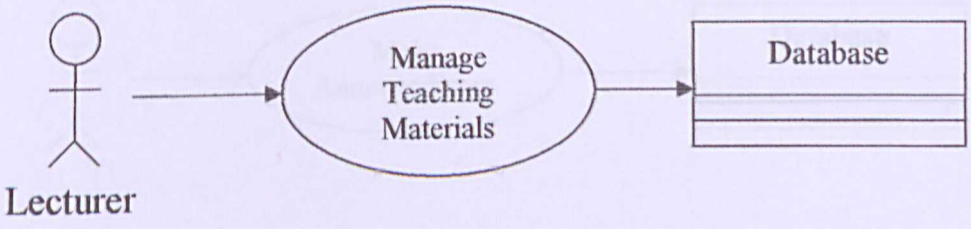
4.1.1.2.5 Manage Teaching Materials



Brief Description

The use case Manage Teaching Materials is initiated by the lecturer to upload or delete the teaching materials.

Initial Step-By-Step Description

Pre-condition: Lecturer has already logged into main page of the administration module.

1. Lecturer clicks on the instructions "Course Materials" from the main page.
2. The system displays a new page.
3. Lecturer clicks on the link "DELETE" to delete the files or click on the link "Upload Files" to upload the files after allocating the file and selecting the folder from dropdown menu.
4. The system refreshes the page and then displays the new page.
6. The system then uploads or deletes the file respectively according to the lecturer's action.

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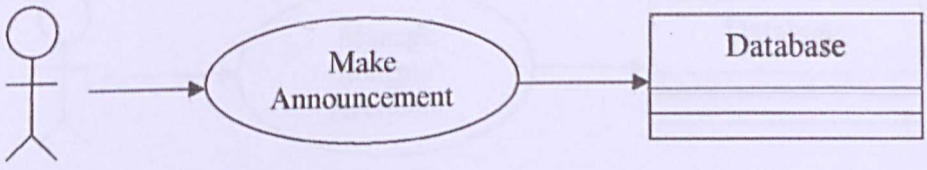
4.1.1.2.6 Make Announcement



Lecturer

Brief Description

The use case Make Announcement is initiated by the lecturer to make announcement on the web site.

Initial Step-By-Step Description

Pre-condition: Lecturer has already logged into main page of the administration module.

1. Lecturer clicks on the "Announcement" from the main page.
2. The system displays a new page.
3. Lecturer inserts any announcement he/she wants.
4. Lecturer then clicks "Submit" after inserting the announcement.
5. The system then uploads the announcement into database to be displayed on the main page of the web site.

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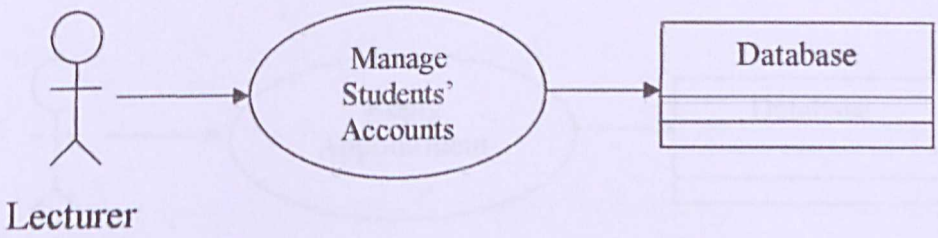
4.1.1.2.7 Manage Students' Accounts



Brief Description

The use case Manage Students' Accounts is initiated by the lecturer to create an account in database for student.

Initial Step-By-Step Description

Pre-condition: Lecturer has already logged into main page of the administration module.

1. Lecturer clicks on the "Student Account" from the main page.
2. The system displays a new page.
3. Lecturer inserts student's details to be added into database or select "Edit" as well as "Update" to change particular student's detail. Lecturer also can delete student record by click "Delete".
4. The system will pop out the message to ask for the confirmation from lecture.
5. Lecturer clicks on "OK" button.
4. The system then deletes the student's account from database.

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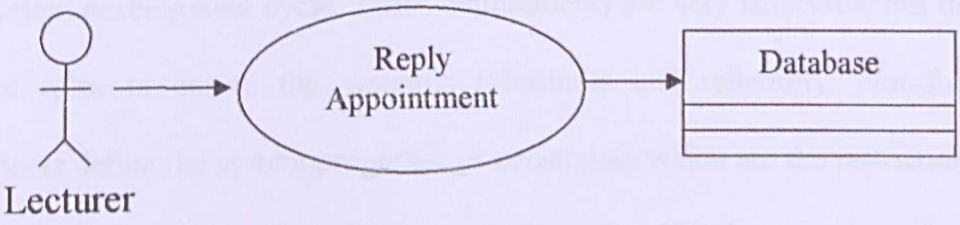
4.1.1.2.8 Reply Appointment



Brief Description

The use case Reply Appointment is initiated by the lecturer to reply to students for the appointment they made.

Initial Step-By-Step Description

Pre-condition: Lecturer has already logged into main page of the administration module.

1. Lecturer clicks on the "Appointment" from the main page.
2. The system displays a new page.
3. Lecturer clicks on the link of particular e-mail address of student and reply to the student.
4. Lecturer can delete appointment record sent by students by click "Delete".
5. The system will pop out the message to ask for the confirmation from lecture.
6. Lecturer clicks on "OK" button.
7. The system then deletes the record from database.

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4.1.2 Non-functional Requirements

Non-functional requirements are the other factors that must be taken into consideration in the system development cycle. These requirements are very subjective but they play important roles to ensure the system's robustness and reliability. Non-functional requirements define the system properties or constraints which are the restriction on the system and limit the options for solving any problem faced by the system.

1. **Usability and User Friendliness**

   This Web based Learning System utilizes the Graphical User Interface (GUI) that provides better visual meaning to the user. The usage of suitable meaningful icons helps to ensure that users will use the system with more confidence and avoid mistakes made by user unintentionally. The icons conveyed information is concise, easy to understand and meaningful. Appropriate prompts and instruction will be shown to guide the user along operation of the system. The screen should show only that which is necessary for the particular action being undertaken. Screen should be designed to make it easy to move from one screen to another.

2. **Consistency**

   Screen can be kept consistently by locating information in the same area each time a new screen is accessed. Information that logically belongs together should be consistently grouped together. It can also enhance the simplicity of the system.

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3. Reliability and Dependability

This Web Based Learning System is reliable and dependable system because it does not cause physical or economical damage in the event of system failure as the program is designed into 2 independent modules. Appropriate messages and prompts are designed to enable users follow step by step easily in using the system. The system should be reliable in performing required functions and operations under stated conditions for stated period of time. It should not cause unnecessary and unplanned down time of the overall environment.

4. Robustness

The system consists of two modules which will be completely tested to ensure each module achieve its expectation. The modules are integrated into system and system testing is started after process integration. Any errors that are discovered during system testing are solved immediately. This is to make sure the system is as robust as what had been expected before.

5. Security

The system must be able to authenticate and authorize valid user. Each authorized user should only see data pertinent to him / her and perform actions according to his / her level of authority.

6. Response Time

The response time for retrieving the information should be short. The input validation should be performed at the client side to minimize the time wasted for passing the input data to the server machine and pass the validation result back to the client machine.

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4.2 Hardware Requirements

In order for the system to function properly, there are a few hardware requirements that have to be met.

Server Hardware Requirements

1. CPU with at least Pentium 150MHz processor.
2. At 2GB of free hard disk space.
3. At least 32MB RAM of memory.
4. Network interface and network connection with recommended bandwidth at 10Mbps.
5. Other standard computer peripherals.

Client Hardware Requirements

The client hardware requirements are quite minimal as long it has a reasonable amount of RAM and a reasonable dial-up connection line. The recommended configurations are :

1. At least 32MB RAM of memory.
2. Network connection via existed network configuration or modem (recommended at least 28.8 Kbps).

4.3 Software Requirements

In order for the system to function properly, there are a few software requirements that have to be met besides the hardware requirements just stated before.

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Server Software Requirements

To host and run the system, the server computer needs to have various supporting software installed such as :

1. Microsoft Windows NT Server 4.0 or higher.
2. Microsoft Internet Information Server 5.0 or higher.
3. Microsoft Access.

Client Software Requirements

The recommended configurations are :

1. Any web browsers (recommended Internet Explorer 6.0 or Netscape Navigator).
2. Any operating system platform (recommended Windows 98 and above).

4.4 Tools and Technology to be Used

After the consideration of technologies to be used in Technology Review of Chapter 2, tools and technology to be used in developing Web Based Learning System for Requirement Engineering Course are decided as below :

4.4.1 Operating System

Microsoft Windows XP Professional is chosen as an ideal platform for developing this project due to its compatibility with most of the web development software, competitive price, scalability, robustness, and its secure NTFS file system. Besides, Microsoft Windows XP gives developers their choice of languages, protocols, user interfaces, and

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application architecture. This platform is required if Internet Information Server (IIS) is used in this project.

4.4.2 Web Server

Microsoft IIS 6.0 is chosen to be web server for this project. IIS 6.0 is the best platform for integrating with existing solutions and for delivering a new generation of web application. The reason on choosing this web server is due to its scalability, robustness, and support for ASP and Internet Server Application Programming Interface (ISAPI) light.

4.4.3 Database

Microsoft Access is chosen as database for this project because it is a non-complicated software and easy to use. With Access, databases can be designed or created very quickly whether simple or complex to create tables, forms, queries and reports. To make the task even simpler, Access comes with a set of wizards. All we need to do is answering a few questions and Access will do the rest for us.

4.4.4 Web Application Programming Language

Due to the comparison done on the constraints, limitations and advantages of the programming language, ASP.NET technology with JavaScript are chosen as main server-side scripting language for this project. The approach choice is due to the fact that it is simple to implement and no extra addition software requirements needed besides Windows XP Professional and Internet Information Server (IIS) 6.0.

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4.4.5 Web Browser

As for web site testing, Microsoft Internet Explorer 6.0 is used to test the web site, as it is the only browser that displays error messages when ASP scripting generated errors.

4.4.6 Web Editor Tool

The web authoring tool that has been chosen in this project is Visual Studio .NET. It is an efficient program as well as allowing working faster and diving into code when needed. Besides, it is a powerful tool to create, build and manage websites.

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Chapter 5 : System Design

System design is the essential nucleus of the software development process and is applied regardless of the development model or standard that is used. The common steps involve analyzing, designing, coding and testing the system to ensure that it conforms to the software specification and requirements.

In this phase, the system requirements gathered during the system analysis phase and research conducted earlier were translated into a representation of system. Input, output, file and database design are produced which include the design of input forms and screens in order to gather input data, data dictionary, file specification and report design.

5.1 System Architecture

The flow of the web application system architecture is designed using client-server architecture. Client-server architecture exists to provide the system developer flexible and robust infrastructures.

A client-server environment very simply involves a client computer that calls for information from a base or server that has the ability to process the request and send back a response. This response will be either positive or negative and often a positive response can have multiple variations. Client software needs to be able to present these responses in the appropriate fashion to present to the user.

Below are descriptions and key advantages and disadvantages of client-server 2-tier and client-server 3-tier architecture environments :

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I. Client-server 2-tier

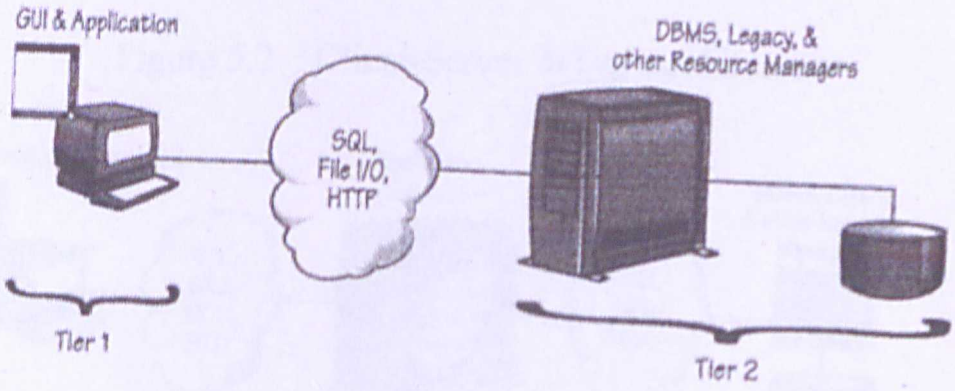
The 2-tier architecture generally describes a client-server environment with additional processing being provided by a database-management server. The main advantage of this set-up is that heavy processing on the client side is minimized and therefore, less client-side software is required. In this case, since many changes are made on the server itself, costly deployment costs can be avoided, especially in a larger organization.

Client-server 2-tier architecture splits the processing load in two (See Figure 5.1). Majority of the application logic runs on the client, which typically sends SQL requests to a server-resident database. This architecture is called "fat client" because a big chunk of the application runs on the client side.

Pro: Ideal for large business, inexpensive workstation software

Con: Expensive server

Figure 5.1 : Client-Server 2-Tier Architecture



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II. Client-server 3-tier

With the client-server 3-tier architecture, processing can be centralized in at the middle tier. In larger enterprise level environments, many database servers may be storing information for a variety of application and business requirements.

In these environments, the middle tier will easily support each different database server by using shared and reusable rules and models. These rules can be changed from a central location, providing standardization and organization for the corporation. 3-tier moves the application logic to the server and it is called "fat server" or "thin client".

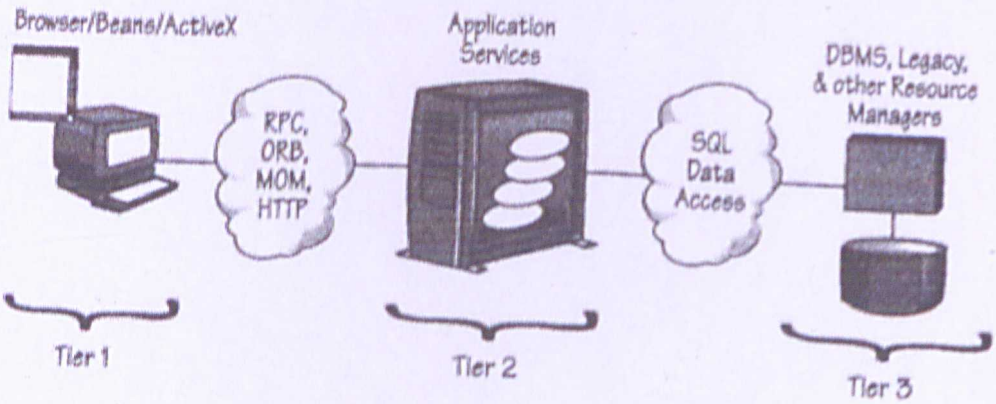
Client-server 3-tier architecture splits the processing load between

1. Clients that run the graphical user interface (GUI) logic,
2. The application server running the business logic,
3. The database or legacy application.

Pro: Performance balancing, rules sharing, organization

Con: Software costs, multiple vendors, complicated infrastructure

Figure 5.2 : Client-Server 3-Tier Architecture



So, the system architecture that will be used for Interactive Web Based Learning for Requirement Engineering Course is Client-server 3-tier architecture. The selected architecture has high data level security and good performance comparing to Client-server 2-tier architecture. Besides, it provides an excellent internet support such as the users can download the applets easier. Client-server 3-tier architecture also has excellent scalability, availability, and hardware architecture flexibility.

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5.2 System Functionality Design

5.2.1 Activity Diagram

5.2.1.1 Activity Diagram for the Log In Use Case

5.2.1.1.1 Teacher View

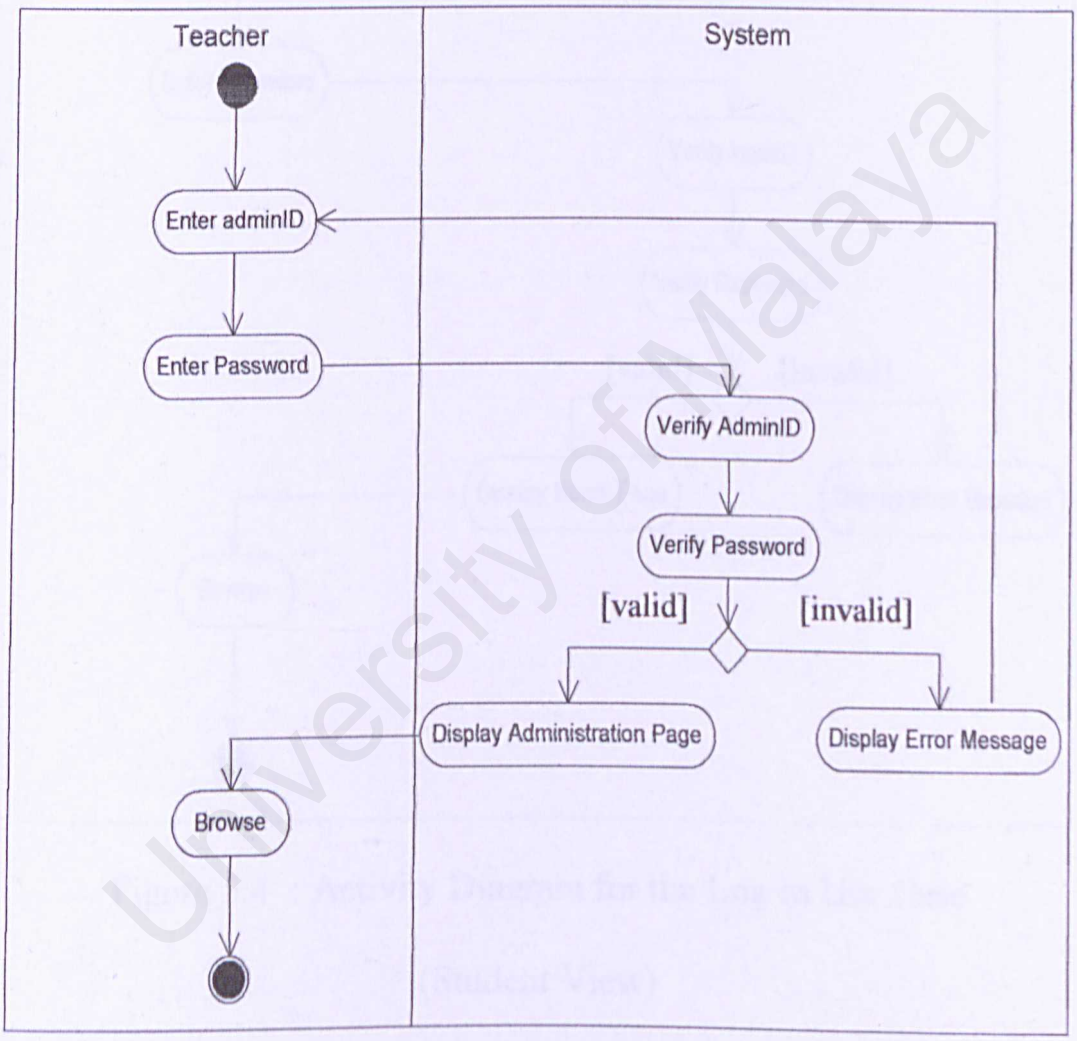

Figure 5.3 : Activity Diagram for the Log In Use Case (Teacher View)

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5.2.1.1.2 Student View

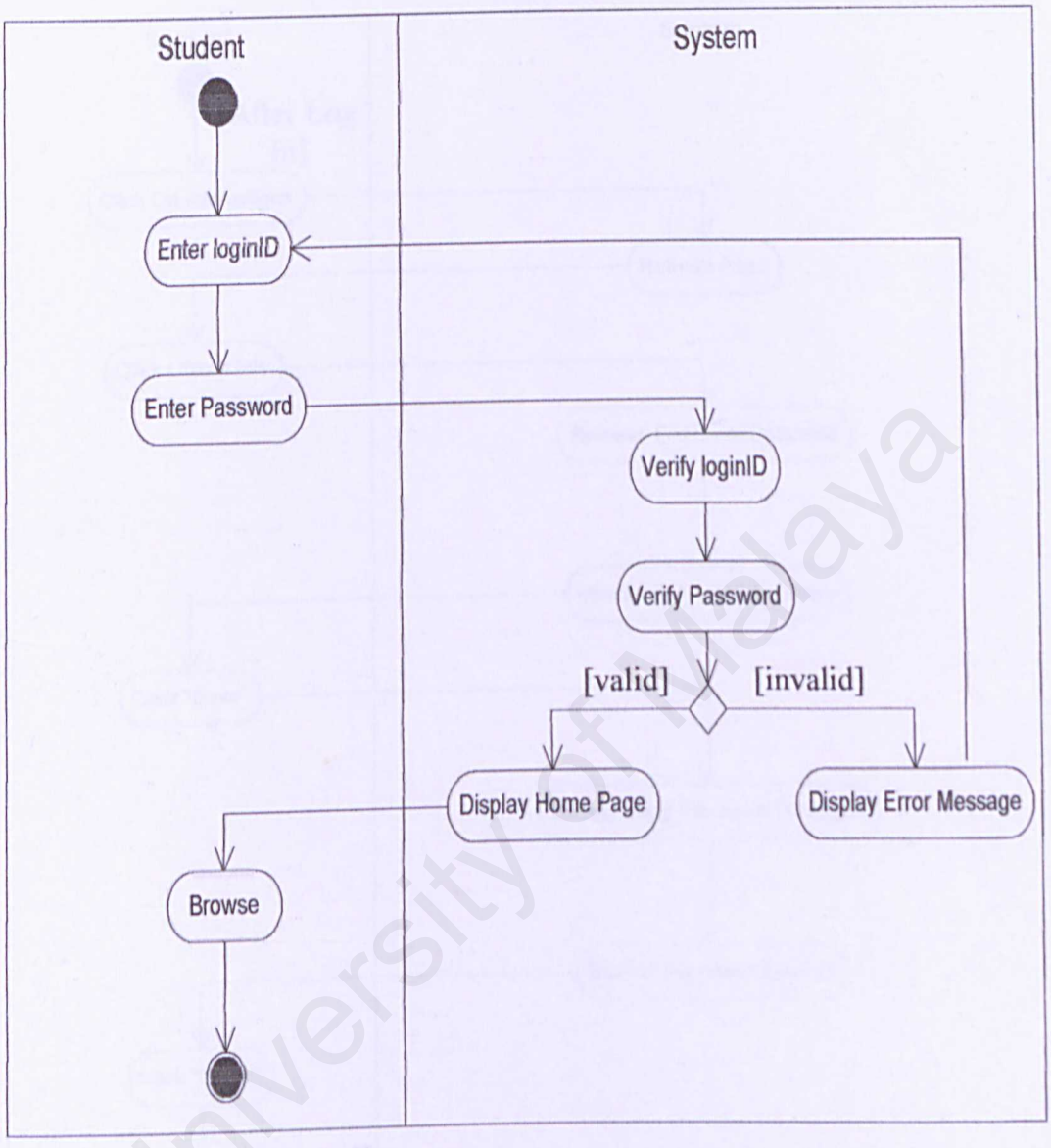

Figure 5.4 : Activity Diagram for the Log In Use Case

(Student View)

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5.2.1.2 Activity Diagram for the Download Teaching Materials Use Case

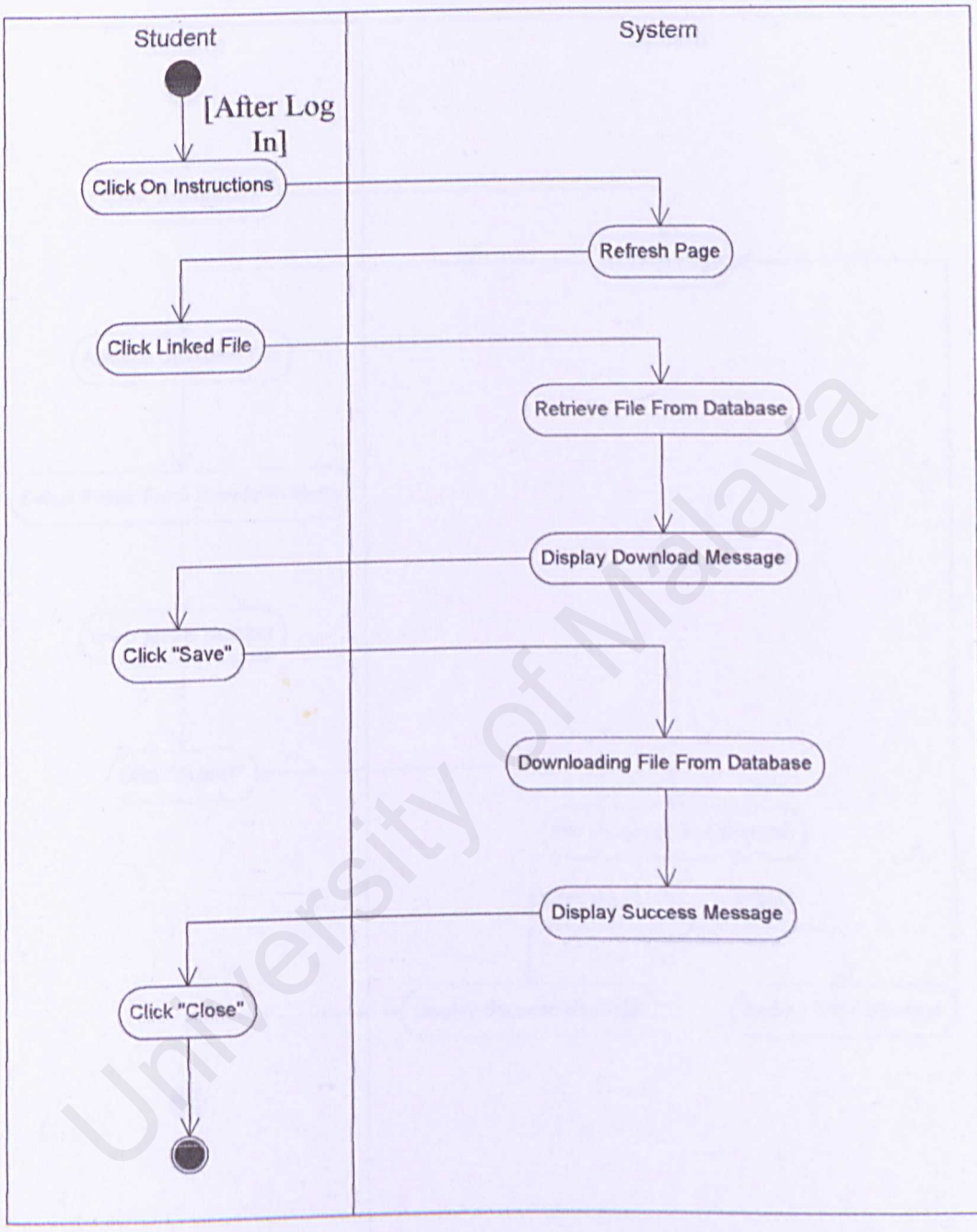

Figure 5.5 : Activity Diagram for the Download Teaching Materials Use Case

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5.2.1.3 Activity Diagram for the Submit Files Use Case

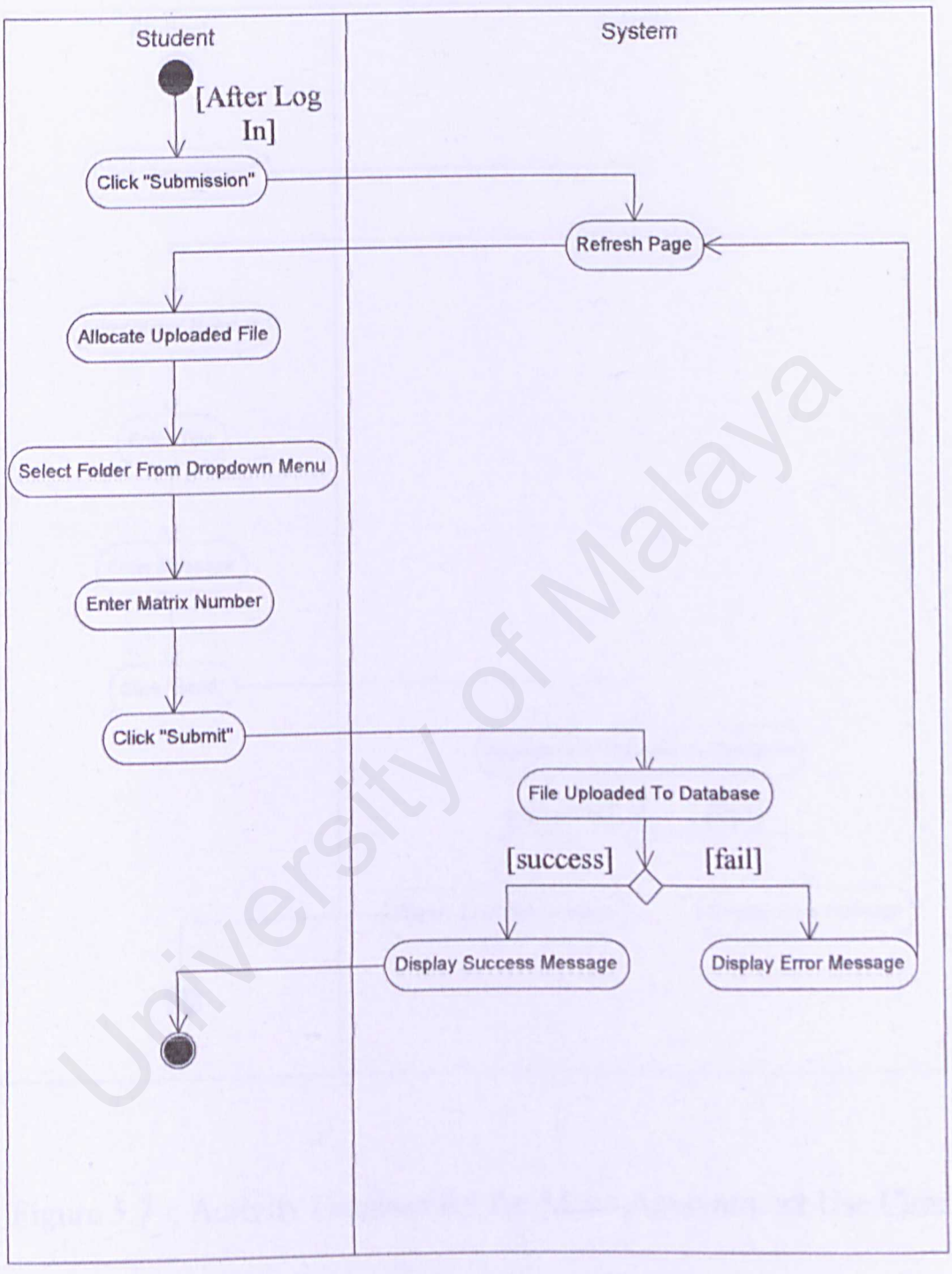

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Figure 5.6 : Activity Diagram for the Submit Files Use Case

5.2.1.4 Activity Diagram for the Make Appointment Use Case

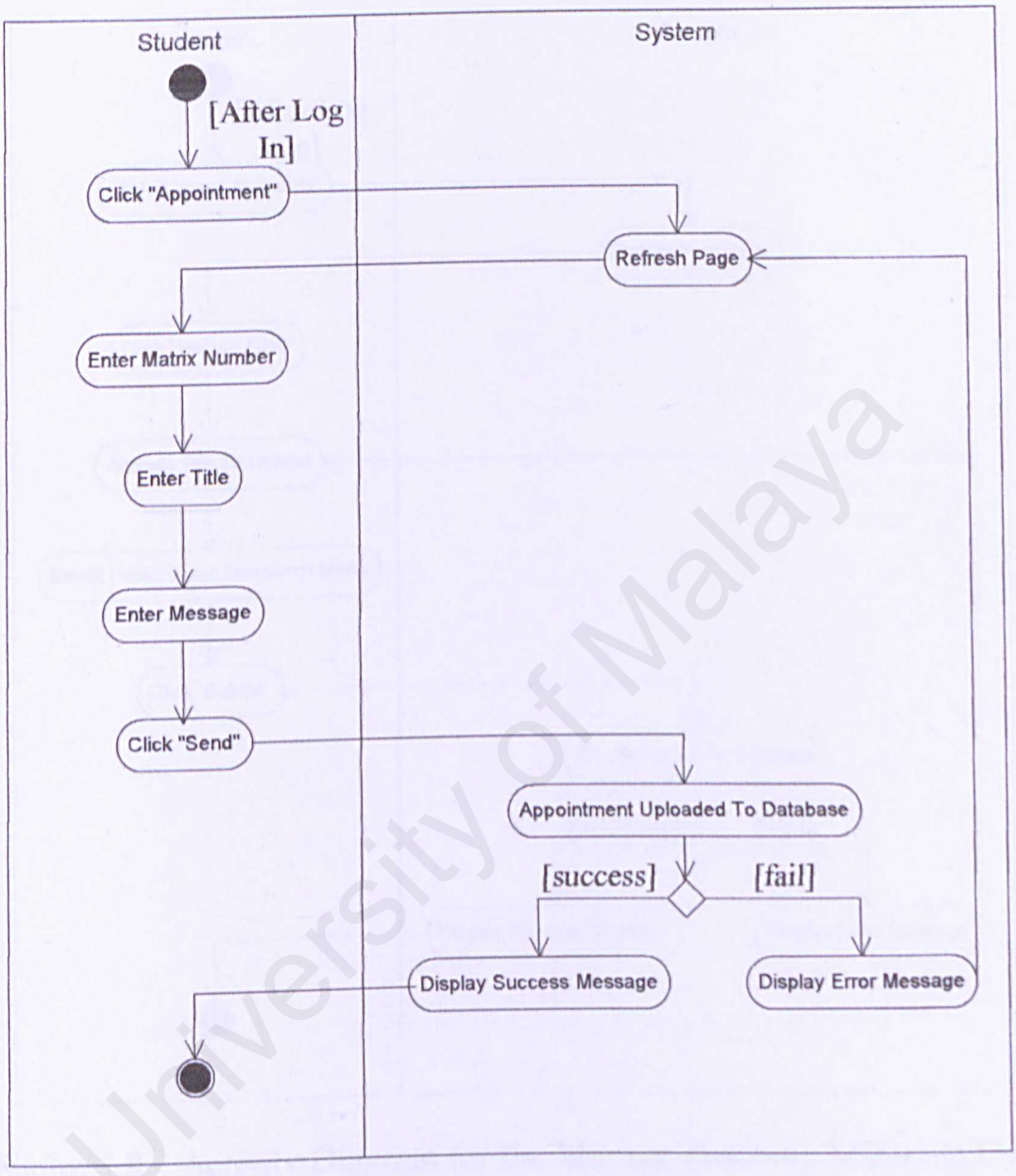

Figure 5.7 : Activity Diagram for the Make Appointment Use Case

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5.2.1.5 Activity Diagram for the Manage Teaching Materials Use Case

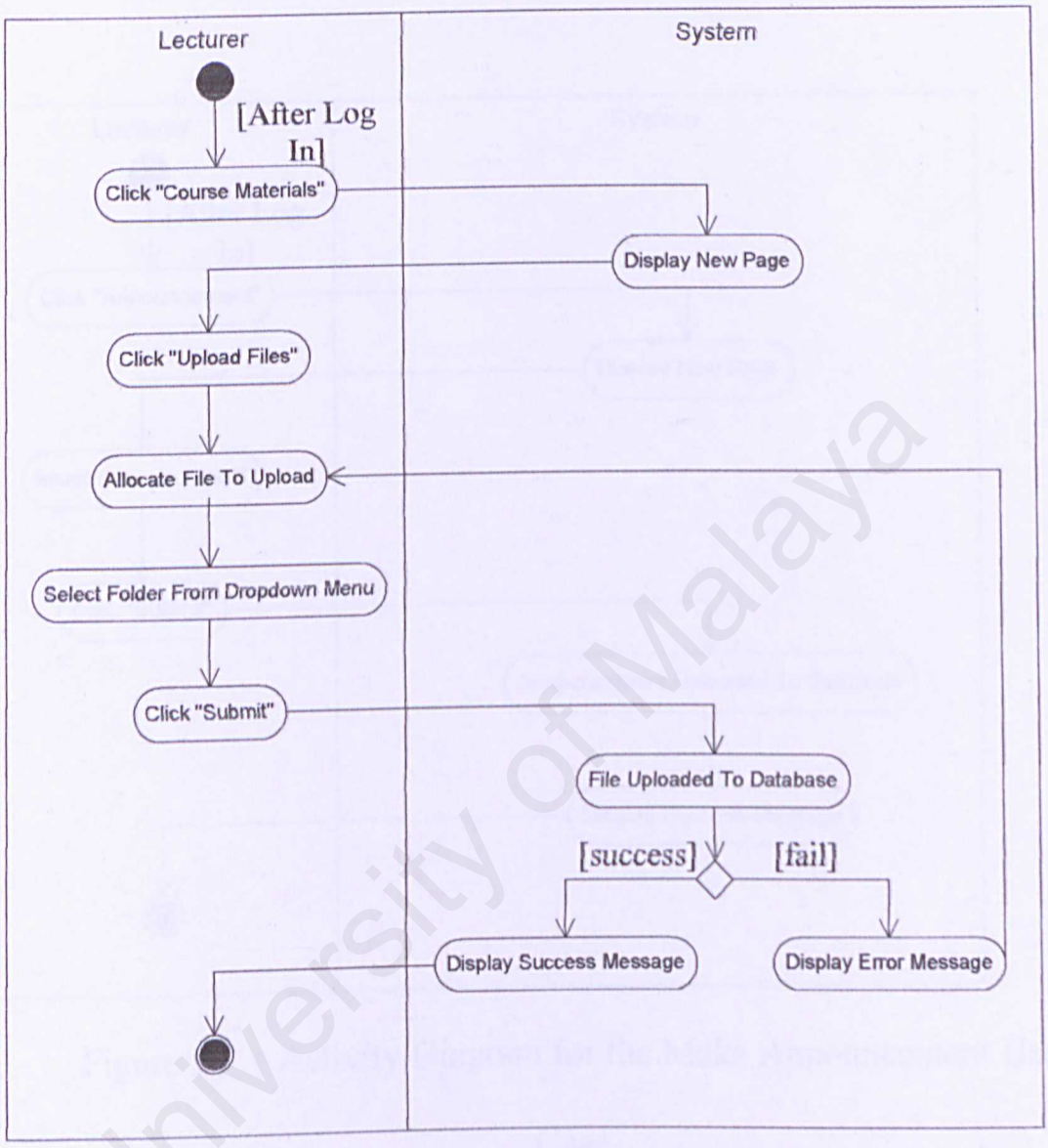

Figure 5.8 : Activity Diagram for the Manage Teaching Materials Use Case (Uploading Teaching Material)

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5.2.1.6 Activity Diagram for the Make Announcement Use Case

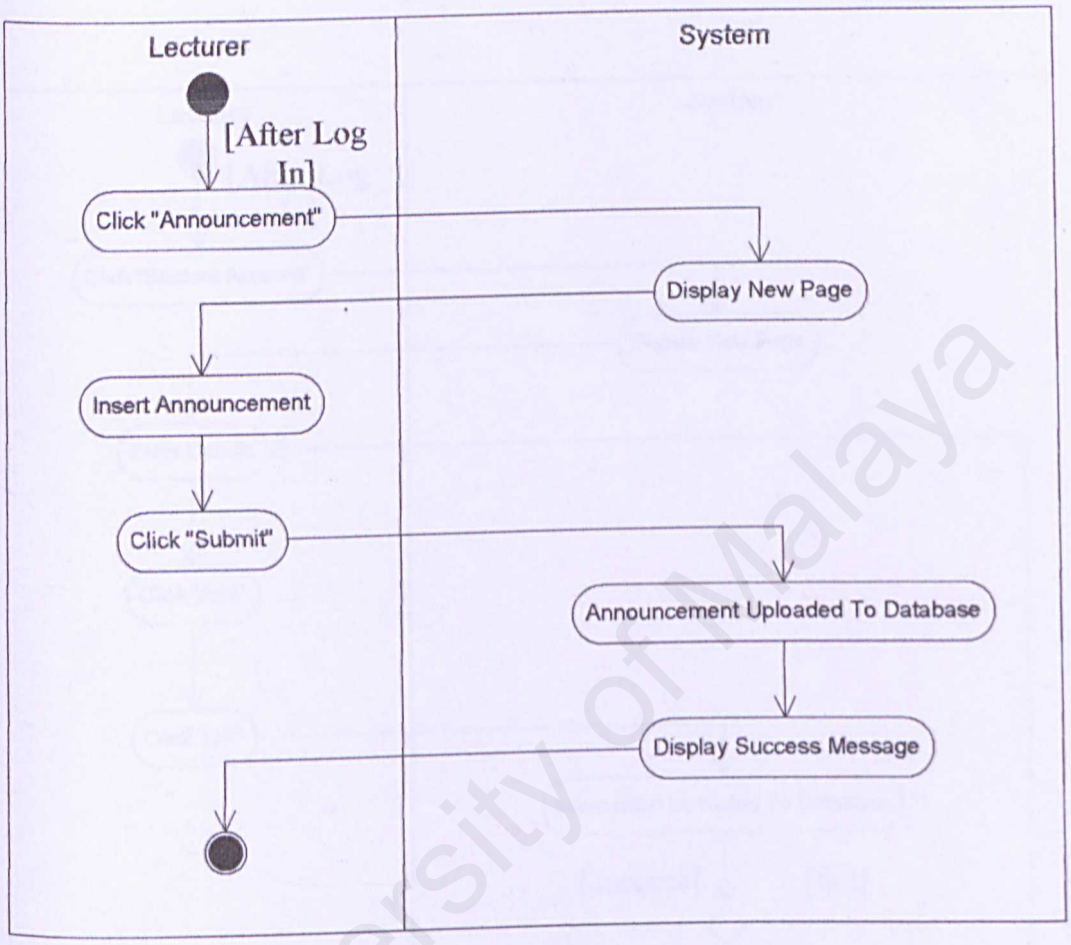

Figure 5.9 : Activity Diagram for the Make Announcement Use Case

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5.2.1.7 Activity Diagram for the Manage Student's Account Use Case

5.2.1.7.1 Create Student Account

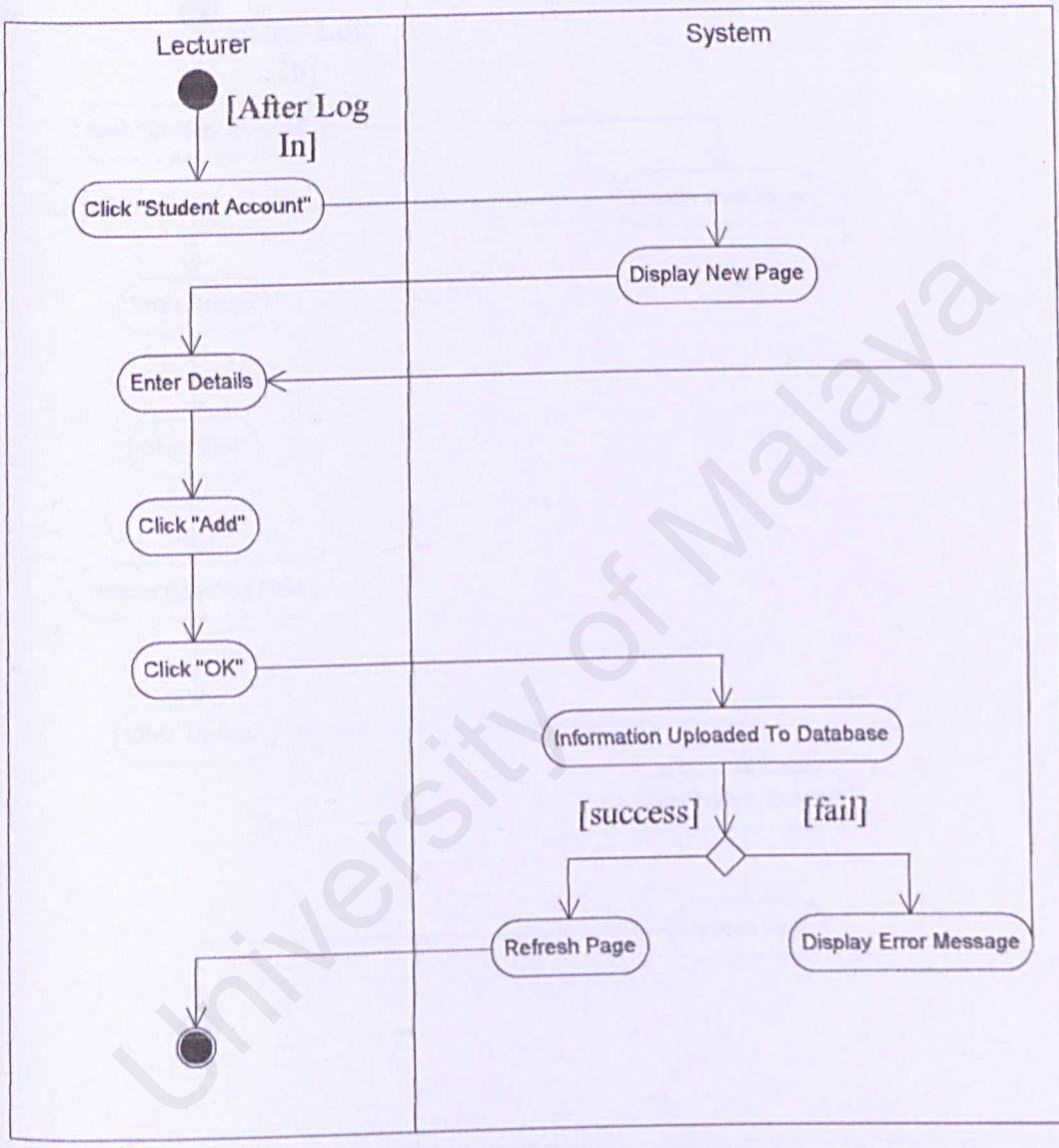

Figure 5.10 : Activity Diagram for the Manage Student's Account Use Case (Create Student Account)

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5.2.1.7.2 Update Student Account

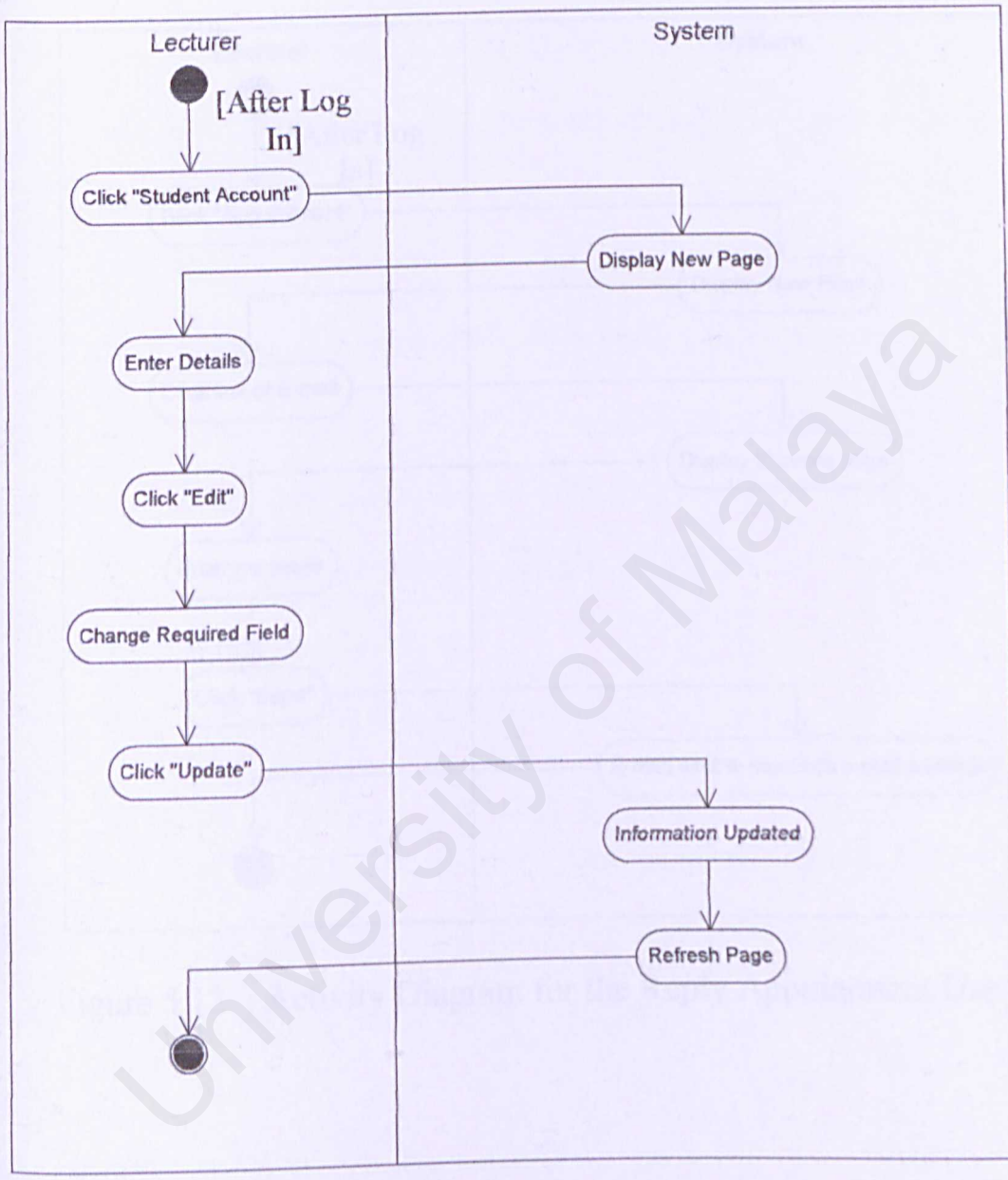

Figure 5.11 : Activity Diagram for the Manage Student's Account Use Case (Update Student Account)

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5.2.1.8 Activity Diagram for the Reply Appointment Use Case

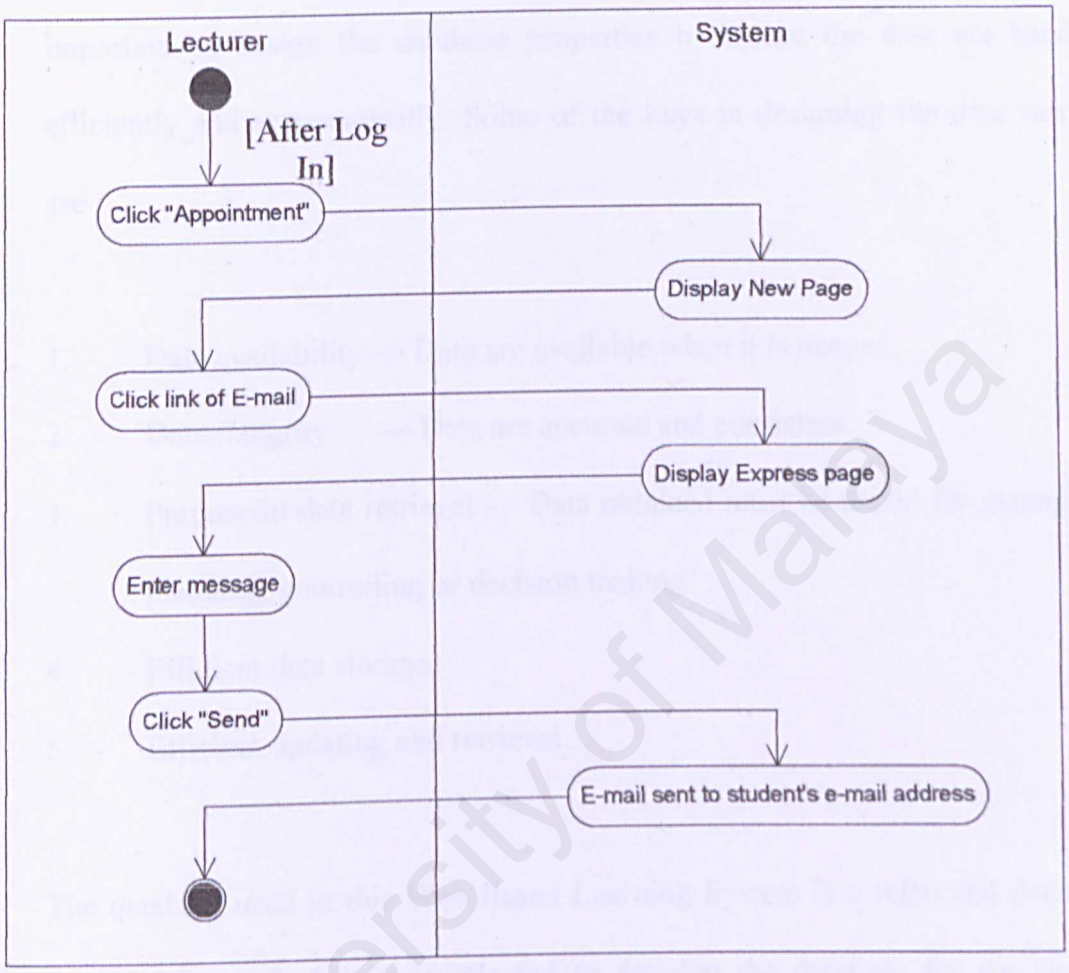

Figure 5.12 : Activity Diagram for the Reply Appointment Use Case

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5.2 Database Design

Data storage is considered to be the heart of the system. Therefore, it is important to design the database properties to ensure the data are handled efficiently and systematically. Some of the keys in designing the data storage are :

1. Data availability --- Data are available when it is needed.
2. Data integrity --- Data are accurate and consistent.
3. Purposeful data retrieval --- Data obtained must be useful for managing, planning, controlling or decision making.
4. Efficient data storage.
5. Efficient updating and retrieval.

The database used in this Web Based Learning System is a relational database model. Microsoft Access is selected to develop the database for the system because of its powerful database application.

5.3.1 Table Name and Function

Table Name	Function
User_login	Records student's loginID, adminID and password.
StudentInfo	Records the student's personal information.
student_submission	Stores the information such as date and

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	time of the submission of students.
announcement	Records the information about announcement such as date and time.
appointment	Records the information of the messages sent by students to make appointment with lecturer

Table 5.1 : Table Name and Function of Database

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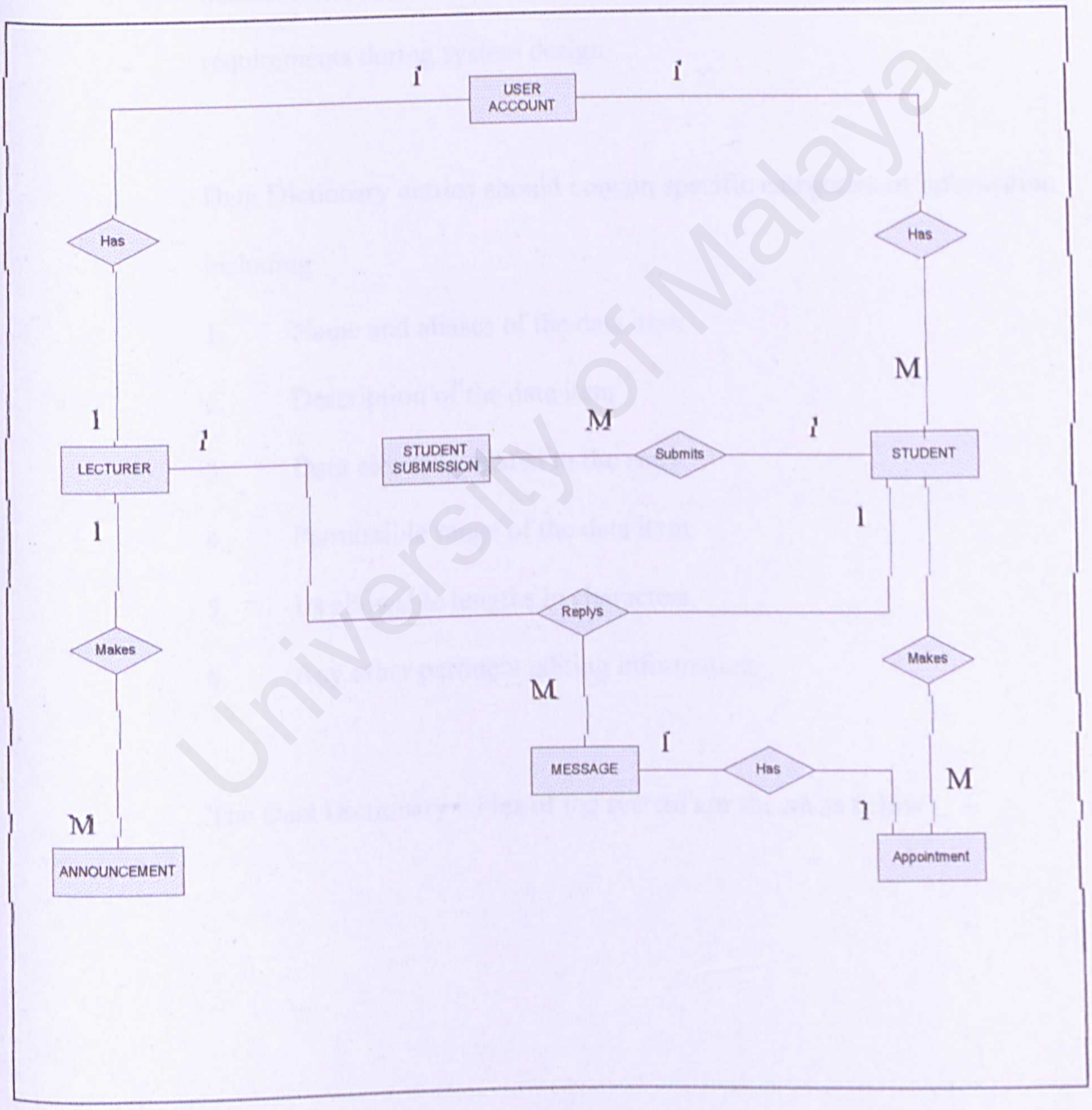
5.3.2 Entity Relationship Diagram

Figure 5.13 : The Entity-Relationship Diagram for Interactive Web Based Learning for Requirement Engineering Course



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5.3.3 Data Dictionary

Data Dictionary, also known as Catalog or Repository, stores the metadata of a system with database. It is a logical characteristic of current system data stores. Data Dictionary identifies processes where the data are used and where immediate access to the information in database needed. It also serves as the basic for identifying database requirements during system design.

Data Dictionary entries should contain specific categories or information including :

1. Name and aliases of the data item.
2. Description of the data item.
3. Data elements related to the entry.
4. Permissible range of the data item.
5. Its allowable lengths in characters.
6. Any other pertinent editing information.

The Data Dictionary tables of the system are shown as below :

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Field Name	Data Type	Size	Description	Primary Key	Foreign Key
loginID	Variable Character	255	Administrator's and Student's login ID	Yes	No
password	Variable Character	10	Administrator's and Student's login password	No	No

Table 5.2 : user_login Table

Field Name	Data Type	Size	Description	Primary Key	Foreign Key
matric_number	Variable Character	10	Student's matrix number	Yes	Yes
student_name	Variable Character	255	Student's Full Name	No	No
email	Variable Character	20	Student's e-mail	No	No
telephone_number	Integer	10	Student's mobile phone number	No	No

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ID	Auto Number	10	Student's ID	No	No

Table 5.3 : studentInfo Table

Field Name	Data Type	Size	Description	Primary Key	Foreign Key
ID	Variable Character	20	Student submission file's ID	Yes	No
matric_number	Variable Character	10	Student's matrix number	No	Yes
submit_date	DateTime	--	submission date of the file by student	No	No
file_name	Variable Character	20	File name submitted by student	No	No
folder	Variable Character	20	Folder name that allocates file submitted by student	No	No

Table 5.4 : student_submission Table

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Field Name	Data Type	Size	Description	Primary Key	Foreign Key
annDate	DateTime	--	Date of announcement made	Yes	No
annInfo	Variable Character	255	Announcement information made by lecturer	No	No

Table 5.5 : announcement Table

Field Name	Data Type	Size	Description	Primary Key	Foreign Key
matric_number	Variable Character	10	Student's matrix number	No	Yes
title	Variable Character	255	Message title	No	No
message_date	DateTime	--	Date of message sent	No	No
message	Variable Character	255	Message about the appointment made by	No	No

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			student		
messageID	Auto Number	10	Message's ID	Yes	No

Table 5.6 : appointment Table

5.3 Interface Design

The interface is the system for most users. It stands as the representation of the system no matter how well or poorly it is designed. An interface is specifically intended to allow the user to access the internal components of that system in a relatively easy fashion. The easier it is for a user to access the system, the better is it the interface. The keys of designing user interface are :

1. Effectiveness

   Allows users to access the system in a way congruent with their needs.

2. Efficiency

   Increases the speed of data entry and reduces errors.

3. User consideration

   Provides appropriate feedback to the users.

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4. Productivity

Ergonomically sound principles of design for user interfaces and workspaces.

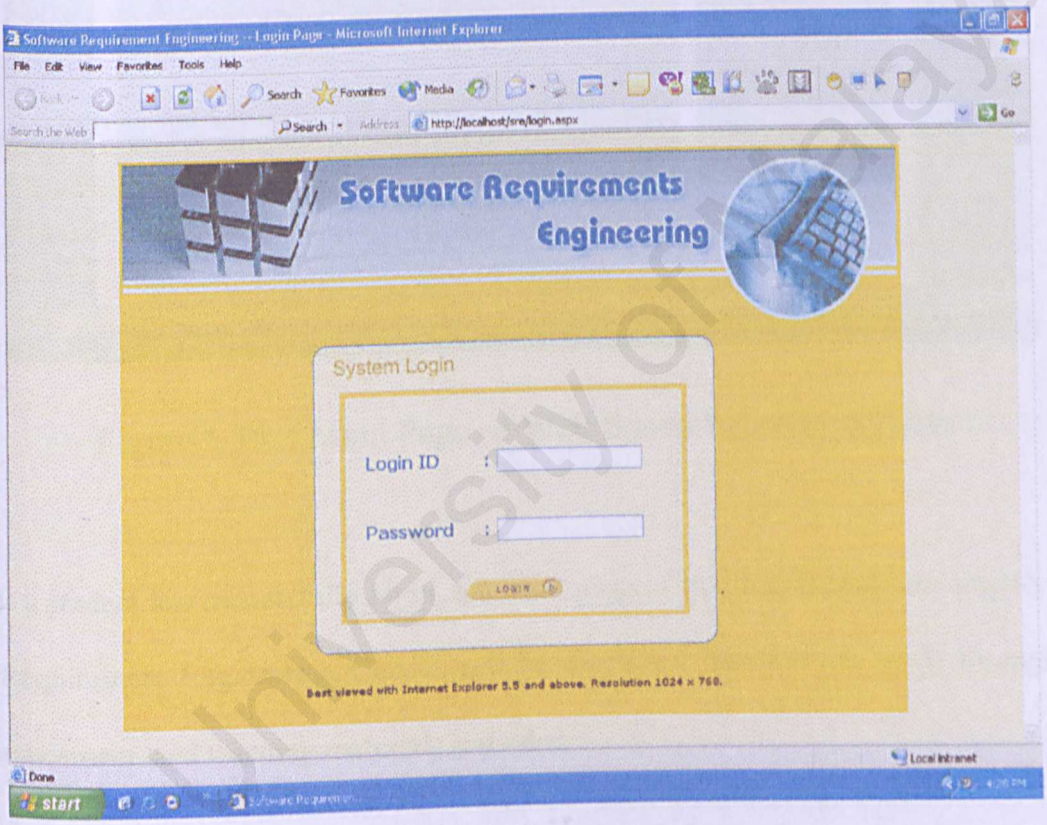

Figure 5.14 : Login Page

The user (lecturer or student) requires to key in either administrator's ID or student's login ID and password before he / she is allowed to enter administration page or the main page of the Web Based Learning System.

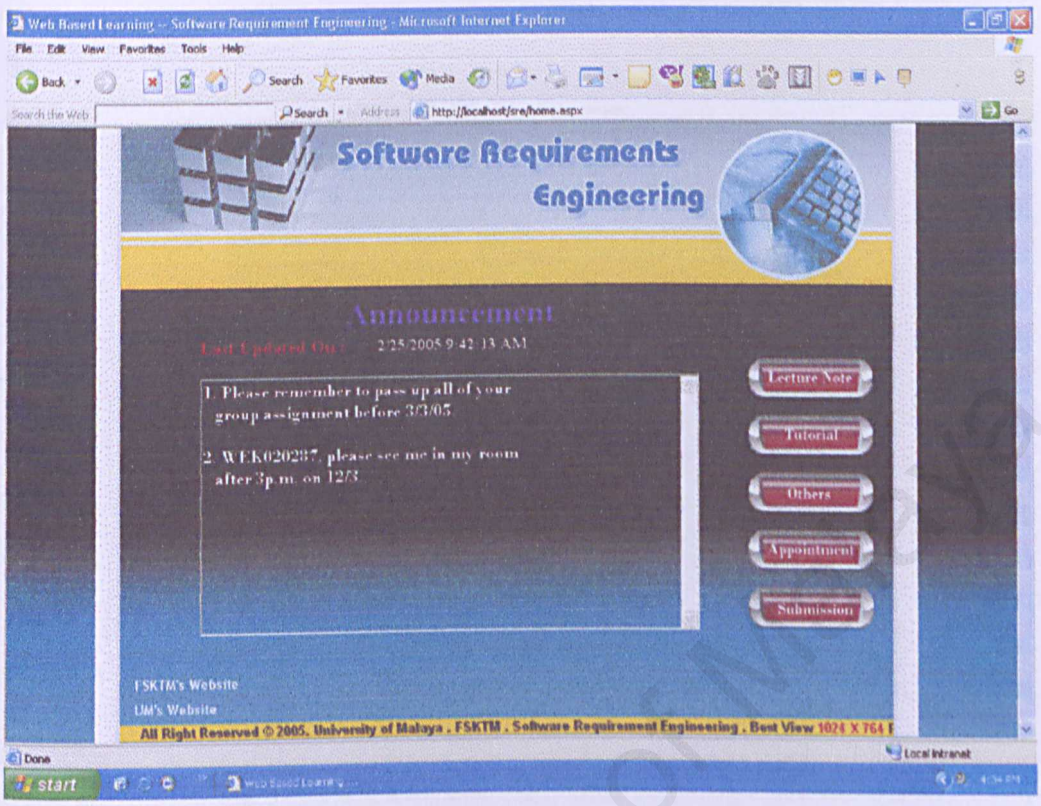

Figure 5.15 : Main Page of Web Based Learning System

After a student has successfully login, the main page of the Web Based Learning System for Requirement Engineering Course will be displayed. Student can reads through the announcement, and teaching materials provided.

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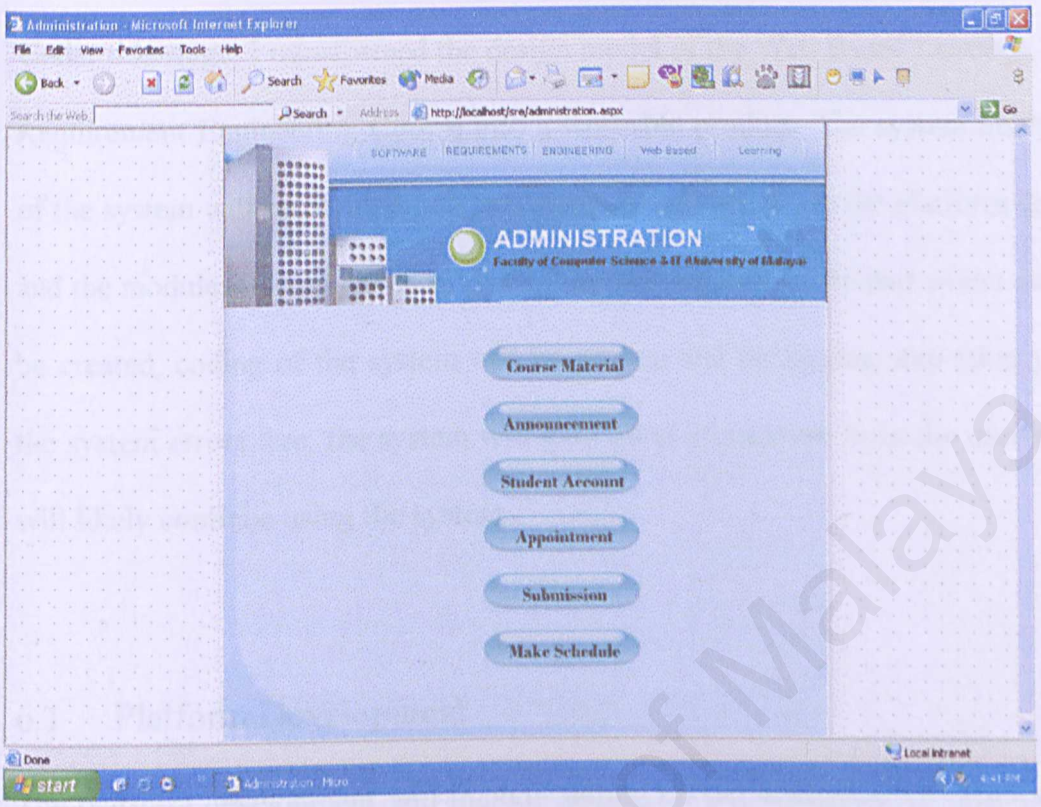

Figure 5.16 : Administration Page of Web Based Learning System

After a lecturer has successfully login, the administration page of the Web Based Learning System for Requirement Engineering Course will be displayed. Lecturer can manage system or his/her files such as teaching materials and announcement through this page.

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Chapter 6 : System Implementation

Under this stage, I transformed the design model of the Web Based Learning System for Requirement Engineering Course into a workable product. The system implementation of the system will be divided into two components, which are the platform development and the modules implementation. System implementation is the part where database will be created, coding of the system will be written and debugging step takes place. With the system errors free, the system will gain good impression from the user so that user will likely continue using the system.

6.1 Platform Development

The platform development will include setting up the Windows XP, Microsoft Access and configure the IIS server. Servers and development tools installations are the very first step before starting off with any development work. When using Microsoft's products, it is essential to know the sequence of products installations to ensure smooth execution without system errors.

6.1.1 Setting Windows XP

1. First, install Microsoft XP Professional
2. Install IIS 6.0
3. Install Visual Studio .NET 2003
4. Install Microsoft Access 2003

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6.1.2 Setting Microsoft Access

After the Microsoft Access had been installed successfully, database named **dbSRE** was created. Then, I created the tables according to the database design. This database will become the database storage for the system. The tables were created for keeping the data used in all modules of this Web Based Learning web site.

I allocated the hard disk space for the database to maximize the performance of the Access and to ensure there is enough of space to store the record.

6.1.3 Configuring Internet Information Server

After installing the IIS, the virtual directory was created so that the user can access the application. The users can access the application through the following address. **http://ServerName/sre/login.aspx**

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6.1.2 Setting Microsoft Access

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6.2 Coding Approach

6.2.1 To Submit (Upload) the File Into Database

```
Dim fileName As String = Nothing
Dim fileLength As Integer = file.ContentLength
Dim fileData(fileLength) As Byte

Dim lastPos As Integer = file.FileName.LastIndexOf("\"c)
fileName = file.FileName.Substring(++lastPos)

file.InputStream.Read(fileData, 0, fileLength)

bf.Append("<span style=""color:white;"">")
bf.Append("<li>'").Append(fileName).Append("'
Received...<br>")
bf.Append("Content-Length:
").Append(fileLength).Append("<br>")
bf.Append("File Name:
").Append(file.FileName).Append("<br>")
bf.Append(" </span>")
```

```
bf.Append("Your Matric Number:
").Append(matNo.Value).Append("</li>")

If uploadFolder.Value <> "" Then
    file.SaveAs(MapPath((uploadFolder.Value + "/" + fileName)))
End If

Dim con As New OleDbConnection(constr)
Try
    Dim cmd As New OleDbCommand(cmdText, con)
    Try
        Dim pms As OleDbParameterCollection =
        cmd.Parameters

        pms.Add("@matric_number", OleDbType.VarChar, 50)
        pms.Add("@submit_date", OleDbType.VarChar, 50)
        pms.Add("@file_name", OleDbType.VarChar, 50)
        pms.Add("@folder", OleDbType.VarChar, 50)

        pms("@matric_number").Value = matNo.Value
        pms("@submit_date").Value = subDate.Text
        pms("@file_name").Value = fileName
        pms("@folder").Value = uploadFolder.Value

        pms = Nothing

        con.Open()
        cmd.ExecuteNonQuery()
    Finally
        cmd.Dispose()
    End Try
```

```
Finally
    con.Dispose()
End Try
bf.Append("<span style=""color:red;""><br>File Uploaded
```

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```
Successfully.....")
bf.Append(" </span></li>")
```

6.2.2 Downloading the File From Database

HTML

```
<TR>
<TD>
      <DIV id="lecture_note" runat="server"></DIV>
</TD>
</TR>
```

VB.NET

```
Dim buffer As New StringBuilder(1024)
Dim dir As New DirectoryInfo(MapPath(folderName))
Dim files As FileInfo() = dir.GetFiles()

If Not (files Is Nothing) And files.Length > 0 Then

buffer.Append("<table align=""center"" width=""50%""
bordercolorlight=""white"" border=""10""
cellspacing=""2"" cellpadding=""2"">")
buffer.Append("<tr><td align=""center""
class=""subTitleColor"">Name</span></td>")
buffer.Append("<td align=""center""
class=""subTitleColor"">Size (Bytes)</span></td>")

Dim file As FileInfo
    For Each file In files

      Dim urlEncFolderName As String =
      Server.UrlEncode(folderName)
      Dim urlEncFileName As String =
      Server.UrlEncode(file.Name)

 buffer.Append("<tr><td align=""center""
 class=""nameColor""><a href=""file.aspx?folder_name=")
    buffer.Append(urlEncFolderName)
    buffer.Append("&file_name=")
    buffer.Append(urlEncFileName)


    buffer.Append("&mode=view"">")
    buffer.Append(file.Name)

    buffer.Append("</td><td align=""center""
    class=""nameColor"">")
    buffer.Append(file.Length)
    buffer.Append("</td><td align=""center""
    class=""nameColor"">")
```

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```
        buffer.Append("</td></tr>")
        Next file

        buffer.Append("</table>")
    Else
        buffer.Append("<div align=""center""
        style=""color:red; FONT-WEIGHT: bold; FONT-SIZE:
        30pt;"">No Lecture Note.</div>")

    End If
    ' Return a string object to the caller.

    Return buffer.ToString()
```

6.2.3 Update Function

```
Dim con As OleDbConnection
Dim constr As String

constr = "provider=microsoft.jet.oledb.4.0; data source=" &
Server.MapPath("dbSRE.mdb")
con = New OleDbConnection(constr)
Try
    Dim cmd As New OleDbCommand("UPDATE studentInfo SET
    matric_number = ?, student_name = ?, email = ?,
    telephone_number = ?, student_password = ? WHERE ID
    = ?", con)
    Try
        cmd.Parameters.Add("@matric_number",
        OleDbType.VarChar, 255).Value = matricNumber
        cmd.Parameters.Add("@student_name",
        OleDbType.VarChar, 255).Value = studentName
        cmd.Parameters.Add("@email", OleDbType.VarChar,
        255).Value = eMail
        cmd.Parameters.Add("@telephone_number",
        OleDbType.VarChar, 255).Value = telephoneNumber
        cmd.Parameters.Add("@student_password",
        OleDbType.VarChar, 255).Value = user_password
        cmd.Parameters.Add("@ID",
        OleDbType.BigInt).Value = id


        con.Open()
        cmd.ExecuteNonQuery()
    Finally
        cmd.Dispose()
    End Try
Finally
    con.Dispose()
      End Try
```

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6.2.4 Verifying LoginID and Password

```
Dim retVal As Boolean
Dim dr As OleDbDataReader
constr = "provider=microsoft.jet.oledb.4.0; data
source=" & Server.MapPath("dbSRE.mdb")
con = New OleDbConnection(constr)

Dim sql As String = "SELECT * FROM user_login WHERE
loginID='" & userName & "'"


cmd = New OleDbCommand(sql, con)
con.Open()
dr = cmd.ExecuteReader()

While (dr.Read())
    If StrComp(dr.Item("password"), userPassword, 1) = 0
Then
        retVal = True
    End If
End While
con.Close()

GetUser = retVal
```

```
Dim retVal As Integer

If Page.IsValid Then

    If txtLoginID.Value = "" Or txtPassword.Value = ""
Then
        retVal = MessageBox.Show("Both LoginID &
        Password Are Required!", "WARNING",
        MessageBoxButtons.OK, MessageBoxIcon.Exclamation,
        MessageBoxDefaultButton.Button1,
        MessageBoxOptions.ServiceNotification)

    ElseIf ValidateUser(txtLoginID.Value,
    txtPassword.Value) = "student" Then
```

```
        Response.Redirect("home.aspx")

    ElseIf ValidateUser(txtLoginID.Value,
    txtPassword.Value) = "lecture" Then
        Response.Redirect("administration.aspx")
    Else
        retVal = MessageBox.Show("Invalid LoginID Or
        Password!", "INVALID", MessageBoxButtons.OK,
        MessageBoxIcon.Exclamation,
        MessageBoxDefaultButton.Button1,
        MessageBoxOptions.ServiceNotification)
    End If
End If
```

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6.2.5 Connect to Database to Display Data

```
constr = "provider=microsoft.jet.oledb.4.0; data

source=" & Server.MapPath("dbSRE.mdb")
con = New OleDbConnection(constr)
sql = "select * FROM studentInfo ORDER BY
       studentInfo.matric_number"

ada = New OleDbDataAdapter(sql, con)
con.Open()

cmd = New OleDbCommand(sql, con)
cmd.ExecuteNonQuery()

ds = New DataSet
ada.Fill(ds, "studentInfo")
DataGrid1.DataSource =
ds.Tables("studentInfo").DefaultView

DataGrid1.DataBind()
con.Close()
```

6.2.6 Adding Data

```
If IsAddNameValid() Then
   HtmlTable2.Visible = False

    constr = "provider=microsoft.jet.oledb.4.0; data
    source=" & Server.MapPath("dbSRE.mdb")
    con = New OleDbConnection(constr)
    con.Open()
```

```
    cmd = New OleDbCommand("INSERT INTO
    studentInfo(matric_number, student_name, email,
    telephone_number) VALUES
    (?,?,?,?)", con)

    cmd.Parameters.Add("@matric_number",
    OleDbType.VarChar, 255).Value = Textbox3.Text.Trim()
    cmd.Parameters.Add("@student_name",
    OleDbType.VarChar, 255).Value = Textbox4.Text.Trim()

    If Textbox7.Text = Nothing Then
        Textbox7.Text = "-----"
    End If

    If Textbox8.Text = Nothing Then
        Textbox8.Text = "-----"
    End If


    cmd.Parameters.Add("@email", OleDbType.VarChar,
    255).Value = Textbox7.Text.Trim()
```

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```
        cmd.Parameters.Add("@telephone_number",
        OleDbType.VarChar, 255).Value = Textbox8.Text.Trim()

        cmd.ExecuteNonQuery()
        con.Close()
    End If
```

6.2.7 Deleting Data

```
        constr = "provider=microsoft.jet.oledb.4.0; data
        source=" & Server.MapPath("dbSRE.mdb")
        con = New OleDbConnection(constr)
        con.Open()

        Dim deleteLnk As HtmlAnchor = CType(s, HtmlAnchor)

    'Retrive the ProductID from the HRef attribute
        Dim id As Integer = Integer.Parse(deleteLnk.HRef)

    'Perform delete procedure.
        Dim cmd As New OleDbCommand("DELETE FROM studentInfo
        WHERE ID = ?", con)

        cmd.Parameters.Add("@ID", OleDbType.BigInt).Value =
        id
        cmd.ExecuteNonQuery()
        con.Close()
```

6.3 Coding Style

The coding style is a very important attribute to determine the readability and maintainability of the source codes. With a clear and systematic coding style, it helps the programmer to see the codes easier in order to help the programmer on maintaining and also debugging the system.

Follows are the coding style being applied:

- Use meaningful variables and labels name (so that references can be done easily)

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For example: Use the variable "txtTitle" for the textbox used to input message title of the appointment made.

```
<TR>
<TD>
<asp:textbox id="txtTitle" runat="server" Width="264px"
 BorderColor="Silver" BorderStyle="Solid">
</asp:textbox>
</TD>
</TR>
```

- Indent the codes according to the functional segments (for example; the "If-Else")

For example: Use "If-Else" to show determine whether id and password input by user is lecturer or student.

```
Dim role As String

If GetUser(userName, userPassword) Then

    If userName = "sreadmin" Then
        role = "lecture"
    Else
        role = "student"
    End If

End If

ValidateUser = role
```

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- Write description or comments in the source codes

  For example: Write a description of the function on the top of the function

```
' Check if the page has been posted back by the user ( by
  clicking 'submit' button ) or not.
' If it has been posted back then proceed to handle file
  uploads and other non-binary data.

 If IsPostBack Then

' PostedFile property of HtmlInputFile controls contains
  the file uploaded by the user.
    Dim uploadedFile As HttpPostedFile = file.PostedFile
    Dim uploadedFile1 As HttpPostedFile =
    file1.PostedFile
    Dim uploadedFile2 As HttpPostedFile =
    file2.PostedFile
```

6.4 Error Handling

To ensure that the system handles errors gracefully, global and local functions were included in the codes. An example of the local error is as below:

```
        Catch ex As Exception
        bf.Append("<li>Error Occurred: ")
        bf.Append(ex.Message).Append("</li>")
```

This statement wills display a error message ("Error Occurred") if got error when upload a file to database. If there is no error, this coding will be ignore and continue to the next coding.

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6.5 Module Implementation

For this system, there are two module implementations; there are Student module and the Lecturer/Administrator module.

6.5.1 Module Implementation for Student

(A) Viewing Announcement

System should display the updated or latest announcement made by lecturer including the updated date and time.

(B) Viewing Lecturer's Schedule

System should provide the month schedules of lecturer that are prepared by lecturer. So, the student can make appointment based on the schedule provided.

(B) Downloading Course Materials

System should provide the course materials such as lecture notes, tutorials, assignments or other files about the course. The students can download these files from the system.

(D) Make Appointment

System should provide the service that can ease the students to make appointment with lecturer by sending a message to lecturer in order to confirm appointment he/she made.

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(E) Submitting File

System should provide the service that can ease the students to submit the file such as their tutorials and assignments through system. So, the lecturer can receive the file easily and it is faster as well as convenient.

6.5.2 Module Implementation for Lecturer (Administrator)

(A) Viewing Uploaded Files including deleting or downloading the files.

(B) Uploading files such as lecturer notes, tutorials, assignments or other course materials.

(C) Make announcement.

(D) Viewing student details such as matrix number and student name.

(E) Update, add, delete or even print student profiles.

(F) Viewing appointment made by students and e-mail students to confirm the announcement made whether it is accepted or not.

(G) Viewing the details of the student submission such as the date and time of submissions.

(H) Make schedules (Calendars) to be uploaded.

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Chapter 7 : System Testing

Testing provides a method to uncover logical error and to test the system reliability. Some types of tests depend on what is being tested, components, group of components, or the whole system.

In developing a system, testing usually involves several stages. First, each program component is tested on its own, isolated from the other components in the system. Such testing is known as unit testing or component testing. This stage of testing verifies that the component functions properly with the types of input and output expected from studying the component's design. After each component has been tested, the interaction between these components must be tested again to ensure that the components can be integrated.

When all components have been unit-tested, the next step is ensuring that the interfaces among the components are defined and handled properly. This step is called integration testing, also known as module testing, which verifies that the all the components work together as described in the module or system design specifications.

Finally, system testing is performed to make certain that the whole system works according to users' specifications. Developers will join the users to perform this stage of testing where the system is checked against the users' requirements description. If there is a need for change, system modification will then be carried out if the users' requirements were not met as described in the specifications. If the users are satisfied with the system's characteristics, the system is ready to be deployed for use.

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For this system, the top-down testing is used, to test the system components as soon as it is coded. Top-down testing tests the high-level of a system before testing its detailed components. After the top-level component has been tested, its stub components are implemented and tested. This process continues recursively until the bottom-level components are implemented.

7.1 Unit Testing

Unit testing concentrates on the smallest unit of software design, which is the module. A module is a collection of components, which are independent from each other. After each component unit has been tested, the interaction between these components is tested. Unit testing is done concurrently with the prototyping phase in the development of this project. For example, "adding a new student profile" is one of the sub-modules with many sub-functions, such as insertion of user information and error handling, and these functions are tested to ensure that the module is error free.

The code was also examined and debugged in order to identify any fault coding. In the development of this Web Based Learning System, unit testing was done after the development of each module and not the end of the development of the whole system. The object and ASP.NET codes were thoroughly checked and tested to ensure that the functions and data were implemented properly as indicated in the design. If there were errors, debugging would be carried out to identify the error before testing the units again.

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Other units that were independently unit-tested are:

1. Opening of connection to the database.

For example:

```
Dim con As OleDbConnection
Dim constr As String
constr = "provider=microsoft.jet.oledb.4.0; data source="
         & Server.MapPath("dbSRE.mdb")
con = New OleDbConnection(constr)
con.Open()
```

2. Insertion of new records into database.

For example:

```
cmd = New OleDbCommand("INSERT INTO   studentInfo(matric_number,
student_name, email, telephone_number, student_password) VALUES
(?,?,?,?,?)", con)
```

3. Modification of existing records.

For example:

```
Dim cmd As New OleDbCommand("UPDATE studentInfo SET
matric_number = ?, student_name = ?, email = ?,
telephone_number = ?, student_password = ? WHERE ID = ?",
con)

cmd.Parameters.Add("@matric_number", OleDbType.VarChar,
255).Value = matricNumber

cmd.Parameters.Add("@student_name", OleDbType.VarChar,
255).Value = studentName

cmd.Parameters.Add("@email", OleDbType.VarChar, 255).Value
= eMail

cmd.Parameters.Add("@telephone_number", OleDbType.VarChar,
255).Value = telephoneNumber

cmd.Parameters.Add("@student_password", OleDbType.VarChar,
255).Value = user_password

cmd.Parameters.Add("@ID", OleDbType.BigInt).Value = id

con.Open()
cmd.ExecuteNonQuery()
```

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4. Delete record from database

For example:

```
Dim cmd As New OleDbCommand("DELETE FROM studentInfo WHERE
ID = ?", con)

cmd.Parameters.Add("@ID", OleDbType.BigInt).Value = id
cmd.ExecuteNonQuery()
```

5. Execution of SQL statements.

6. Returned query results from search module based on several criteria.

7. Adding new information records into database.

8. Clearing or updating of the list.

9. Normal data test:

Test by using normal data to check whether the system works properly under normal situation.

10. Extreme data test:

Test with invalid data (includes large amount of data, input non-numerical data into a numerical field, redundancy of the key item) that is not supported by the input field.

7.2 Module Testing

The objective of module testing (also known as integration testing) is to take unit-tested modules and build program structure that encapsulates all of the related modules. This testing will ensure that the module calling sequence in this project is systematic.

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All the VB objects (basic and class modules), Java scripts and VB scripts were integrated and tested to ensure the success of the integration. The next step was to combine the execution of ASP.NET scripts and the modules to make sure that the ASP.NET scripts can "communicate" with the modules.

For the Student module, the following test has been carried out:

- Login has been checked when a user login into this system when they want to enter this Web Based Learning System.

- The downloading and uploading functions are fully testing.

- All the button were fully testing and can perform the best.

For the Administrator module, the following test has been carried out:

- All files including previous files will be displayed after lecturer uploads the files to database.

- The system will always display the latest announcement which is made by lecturer according to the latest date and time.

- After adding a new student detail, the current total of students and all students' details will be displayed. The "Edit", "Update", "Delete", "Cancel" and "Print" buttons are functioning well.

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- After reading the message sent by students for appointments, the lecturer can send e-mail to students for the confirmation to accept that appointment by just clicking the link of e-mail. This function is functioning best.

- The details of student submission also displayed well for the lecturer to check whether the students submit the files on time or not.

- The function of making schedule is functioning well too including the functions of uploading the schedules and viewing uploaded schedules.

7.3 Integration Testing

The purpose of integration testing is to test the integration of overall performance of the system. The criteria taken in the accounts are:

- Interface integrity

  Internal and external interfaces are tested as each modules to check if there is any lost of data across interfaces.

- Functional validity

  Tests designed to uncover functional errors are conducted.

- Information content

  Tests designed to uncover errors associated with local or global data structures are conducted.

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- Performance

  Tests designed to verify performance bounds established during software design are conducted.

7.4 System Testing

The last testing procedure is system testing. Once all the modules are tested, they are tested in concert to verify that all the elements are functioning and interfacing with each other properly. The testing result will show whether or not the entire system specifications and objectives are achieved.

The two system tests performed are as below:

- **Security Testing**

  This system is tested to be secured from improper penetration and unauthorized access, for example the implementation of user login.

- **Compatibility Testing**

  This test was performed, and the interface functions according to the requirements. The accuracy of data retrieval was best without an error, and the speed of data retrieval was acceptable.

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7.5 Test Cases

As there are too many test cases involved, only three test case examples will be shown.

- **EXAMPLE 1**

  Navigation testing for this system is tested to be functioning properly, when all links in the content frame of the web page navigate to the appropriate web pages correctly.

- **EXAMPLE 2**

  Log in page was tested when I input different loginID and password to confirm only the information will be displayed for that correct data input.

- **EXAMPLE3**

  Only the students who have information in database are allowed to submit their files to lecturers.

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Chapter 8 : System Evaluation

After the system implementation of the system, the end product of the project was brought up for evaluation. They were many evaluation techniques that used to evaluate the final system. The following section will explain in detail about the system strength and its limitation. From the limitations, the performance of this system can be enhanced in future.

8.1 System Strength

- **Simplicity of User Interface**

  The graphic interface design of the system was designed to let the users feel comfortable and easy-to-use. The GUI ensured user friendliness. Thus, the users should find it easy to use.

- **Web Enabled**

  The system was based on the web technology. It was using the client server approach that allowed processing load to be shared between the client and the server, thus reducing the burden on the server and allow it to provide better service.

- **Ease Use**

  Lecturer and students will find this system is very user friendly and easy to understand. The whole system is simple to be used.

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- **Significant validation on input data**

  Check for the validation of every data input in the field and prompt the user of invalid data being input and ask for valid data. Data field that required will also prompt the user about the error if the user do not fill the required field.

8.2 System Limitation

- **Failed to Support Forum or Chat Room**

  This system didn't support forum or chat room because lack of time to build it.

- **Students Need to Input Matrix Number Each Time They Submit Files**

  Although it is a small problem but it is quite troublesome for student to input matrix number each time.

- **No Font or Style Can Be Used to Make Announcement**

  No other font or style used for making announcement. This will make the announcement not attractive enough.

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8.3 Future Enhancement

Some functionality of the system can be enhanced in order to improve the quality of the system. The following are the functionality that can be enhanced on this system.

- **Support Forum or Chat Room**

  The system should provide forum or chat room for the students. It is actually useful for them to discuss about their problems about the course.

- **Matrix Number of Students Can Be Automatically Passed Into Database**

  The system should not request the students to input their matrix number every time they submit the files. Their matrix number can be automatically store in the database with their particular files' records. This can be done by requesting the students to login using their own matrix number and password.

- **Usage of Fonts and Styles for Announcement**

  The usage of fonts and styles for announcement can be implemented in this system to display more attractive announcement.

8.4 Problem Encountered

During the entire development of this system, many and various problems were encountered. Some of them could be overcome through certain solution while some of them were not. The problems that encountered can be divided into different types. The following are some of the problems that arose during the development process.

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✍ **Set Up and Configuration**

The set up of the server are critical for the operation of the application development. However, the setup process took a long time because lacked of experience. Besides, the repeated failure of the server required re-installation as a remedy and this consumed time and effort.

✍ **Requirement Changes**

It is very difficult to develop and implement the system when the requirement changes very frequently. Sometimes it is easy to change the requirement, however, the coding need to be changed a lot in order to follow the new requirement.

8.5 Knowledge Gained

During the entire development of the Web Based Learning System, I gained a lot of knowledge. The following are some of the knowledge that I gained from the project.

✍ **Setting Up Different Kind of Tools**

During the process of development, I had the opportunities to set up or install local server. Besides, I had better understanding on ASP.NET and VB.NET coding. Several discussion and presentation were held to share my knowledge with friends and solving the difficulties.

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- **Additional Software Tools**

  From this project, I gained knowledge on using PhotoImpact to create buttons and background of web site. Besides, JavaScript and Macromedia Flash also are the new language and software which I can learn in developing Web Based Learning System for Software Requirements Engineering Course.

8.6 Reviews on Goal

At the final stage of the project, there were certain expectations on what would be achieved. The following are the expectation that achieved.

- **Expectation Achieved**

  In overall, the system had fulfilled the expectation stated by the project. The basic foundation of the system was designed and implemented. It was eligible for future growth and implementation. The system met the criteria like reliability, user friendliness and wide accessible.

- **Objectives Achieved**

  The project had successfully created a system that supported the needs for students and lecturer unless there has no forum or chat room provided. Finally, it could be concluded that the objectives to establish the web site had been achieved.

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8.7 Overall Conclusion

The Web Based Learning System was an Internet-based system, designed as an basic learning system for students. The system generates timely, accurate and relevant information. It is very important for lecturer to conduct this course. However, there are also some limitations that the system can't be done. It needs to be enhanced in order to transform it to a more advance system. Despite the limitation, the project had reasonably achieved all its objectives.

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USER MANUAL: TABLE OF CONTENTS

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Chapter 1: Introduction

Interactive Web-based Learning for Requirements Engineering Course is a web-based system runs through Internet with a centralized database. In this system, I have divided into two modules. Those are Student Modules and Lecturer (Administrator) Module.

It is a system that provides better quality education, services and facilities to students. The system also facilitates lecturer in aspect of giving out notes, tutorials, submission of assignment as well as enhancing the interaction between students and lecturer or students and students, such as making an appointment with lecturer online.

The system offers features like downloading and uploading notes, tutorials and assignments for both students and lecturer. Students can obtain any learning materials and submit their assignments for the course easily through this web-based system.

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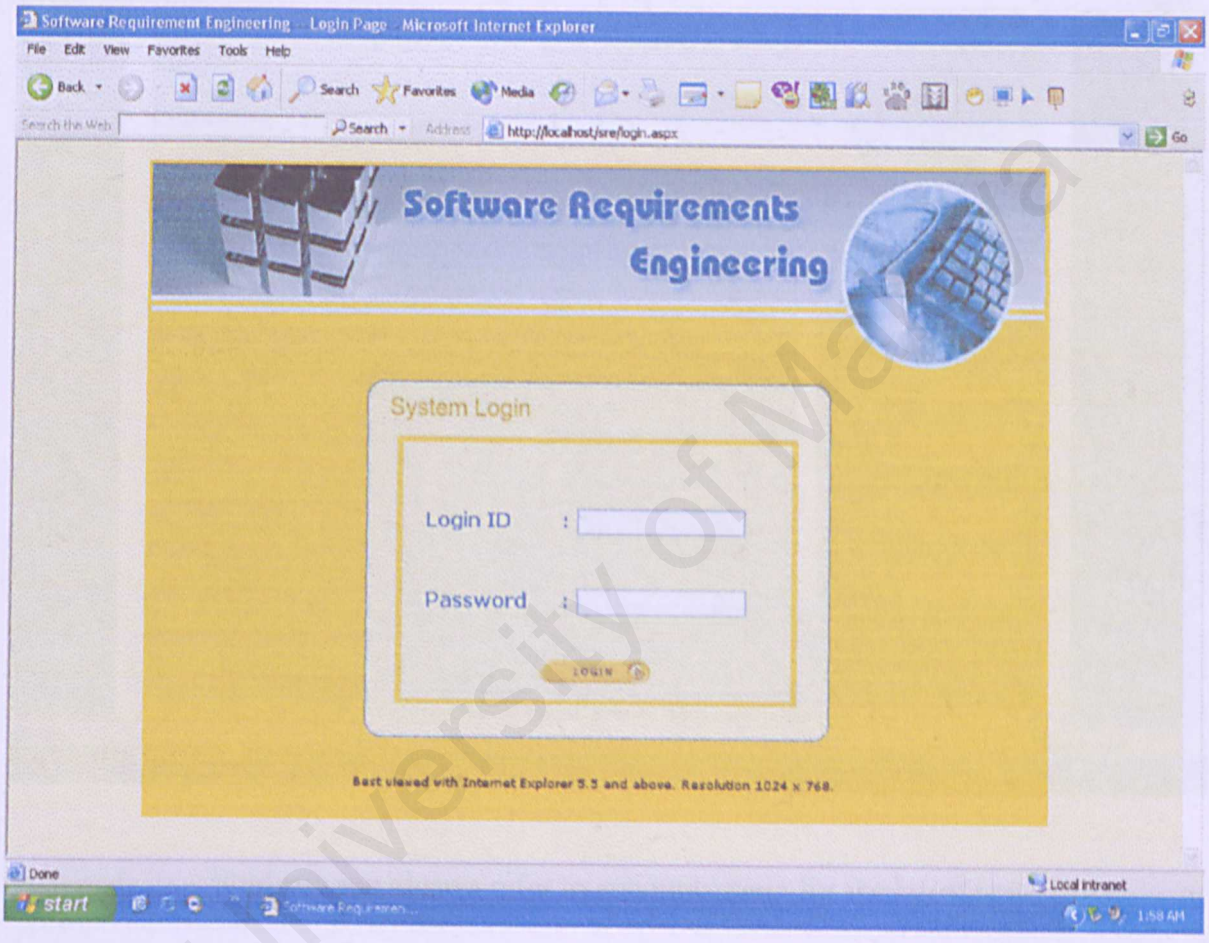
Chapter 2: Getting Started

2.1 Connect to internet.

2.2 Logon to the web site.

Figure 2.1 Homepage of Interactive Web Based Learning System for Requirements Engineering Course



1. If loginID and password used by user is for student, the page will refresh and go to page that are browsed or used by student.

2. If loginID and password used by user is for lecturer (administrator), it will go to the administration page.

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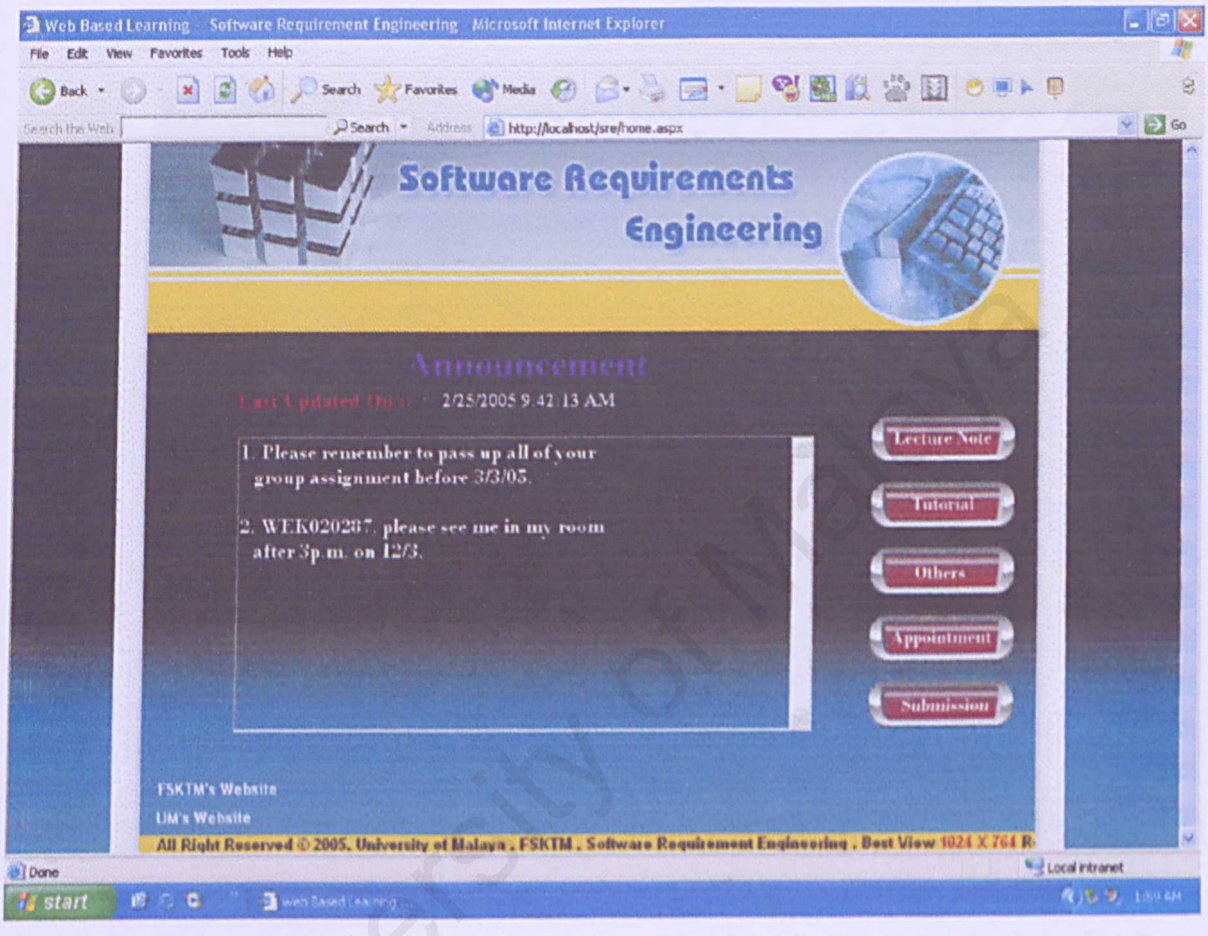
Chapter 3: Browse by Student (Student Module)

Figure 3.1 First Page of Student Module



1. Students can always refer to announcement for the latest news from lecturer.

2. They also can click on the buttons for other functions provided in this system.

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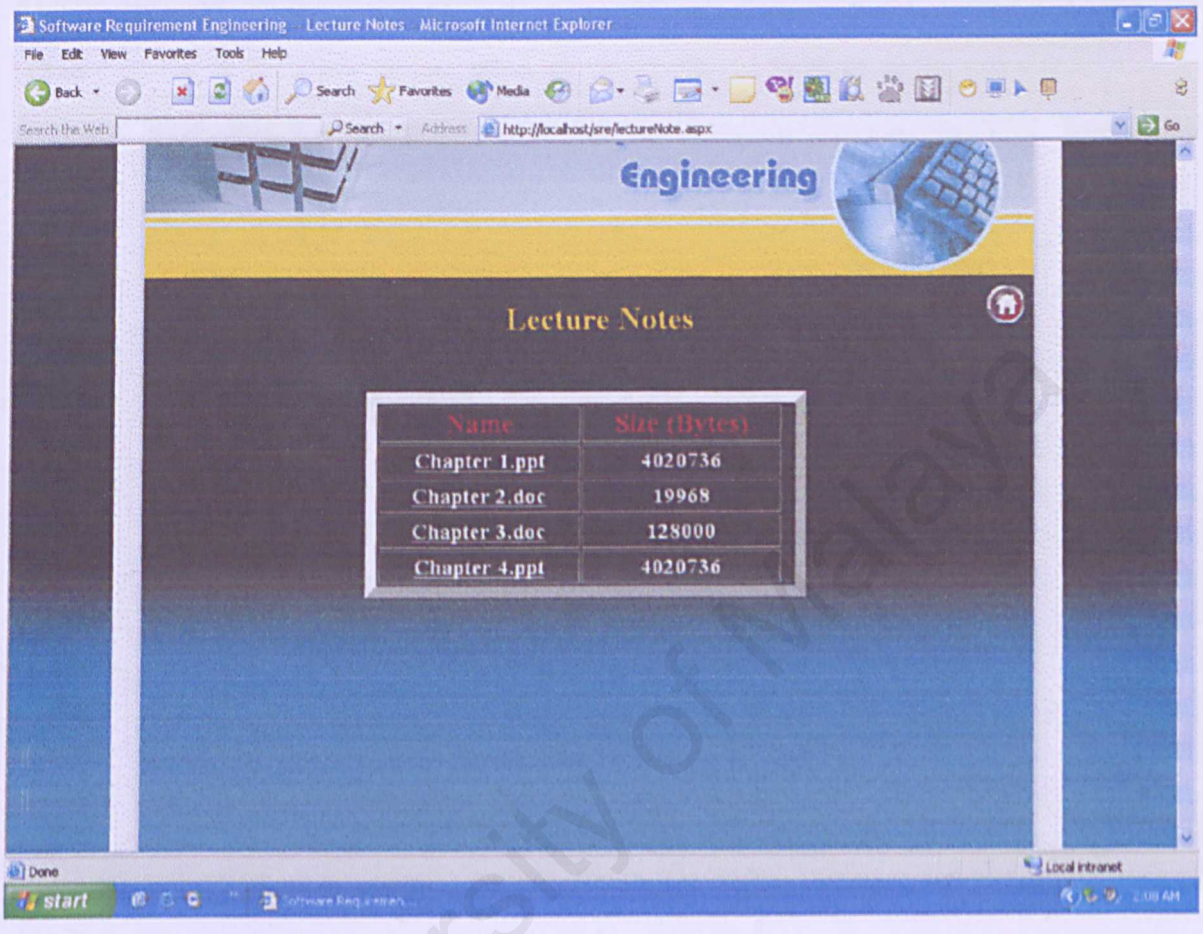
Figure 3.2 Downloading Lecture Notes



1. This page is provided for students to download lecture notes by just clicking on name of the file displayed.

2. Students can also know the actual size (in bytes) of file that will be downloaded.

3. By clicking on "home" button, the page will then back to the first page of the student module.

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Figure 3.3 Downloading Tutorials

1. This page is provided for students to download tutorials by just clicking on name of the file displayed.

2. Students can also know the actual size (in bytes) of file that will be downloaded.

3. By clicking on "home" button, the page will then back to the first page of the student module.

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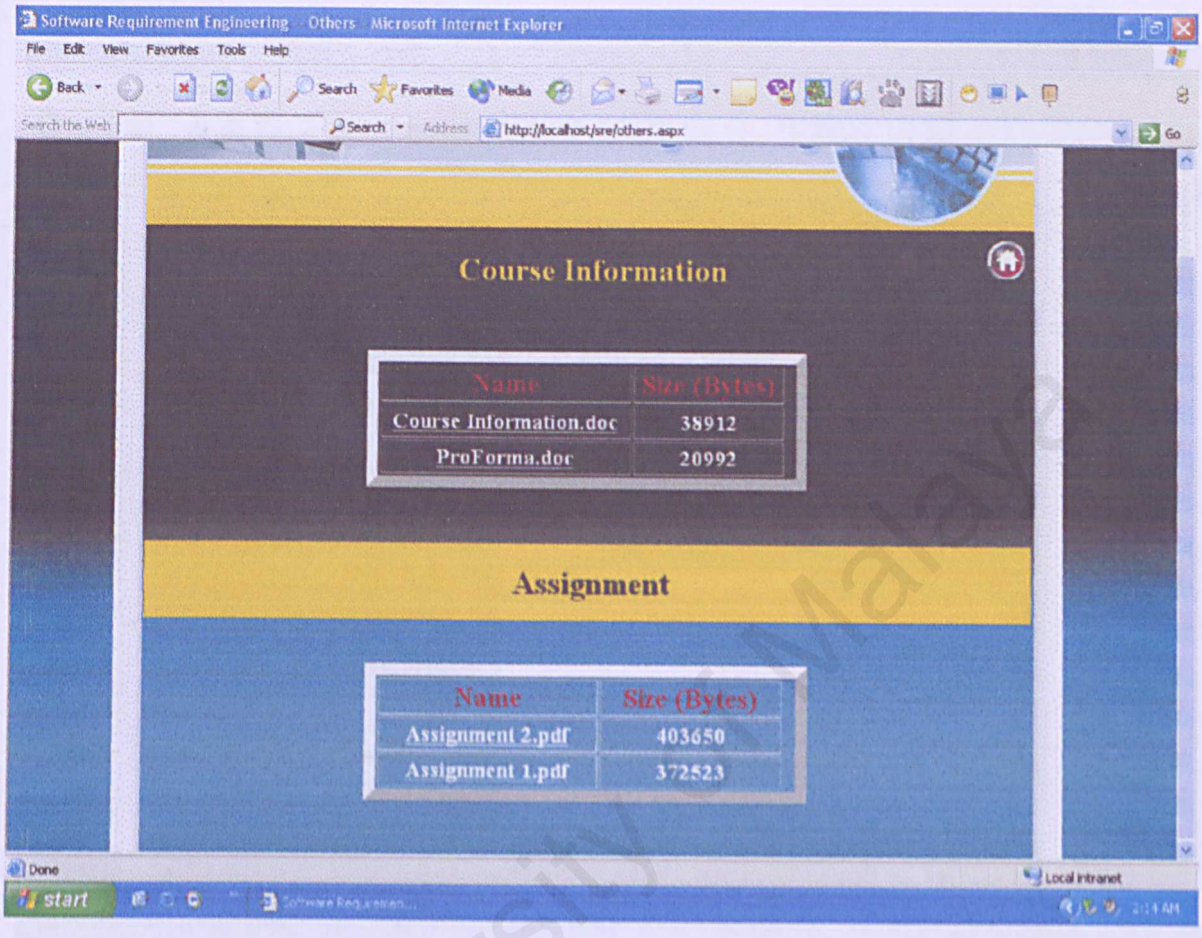
Figure 3.4 Downloading Others (Other Files)

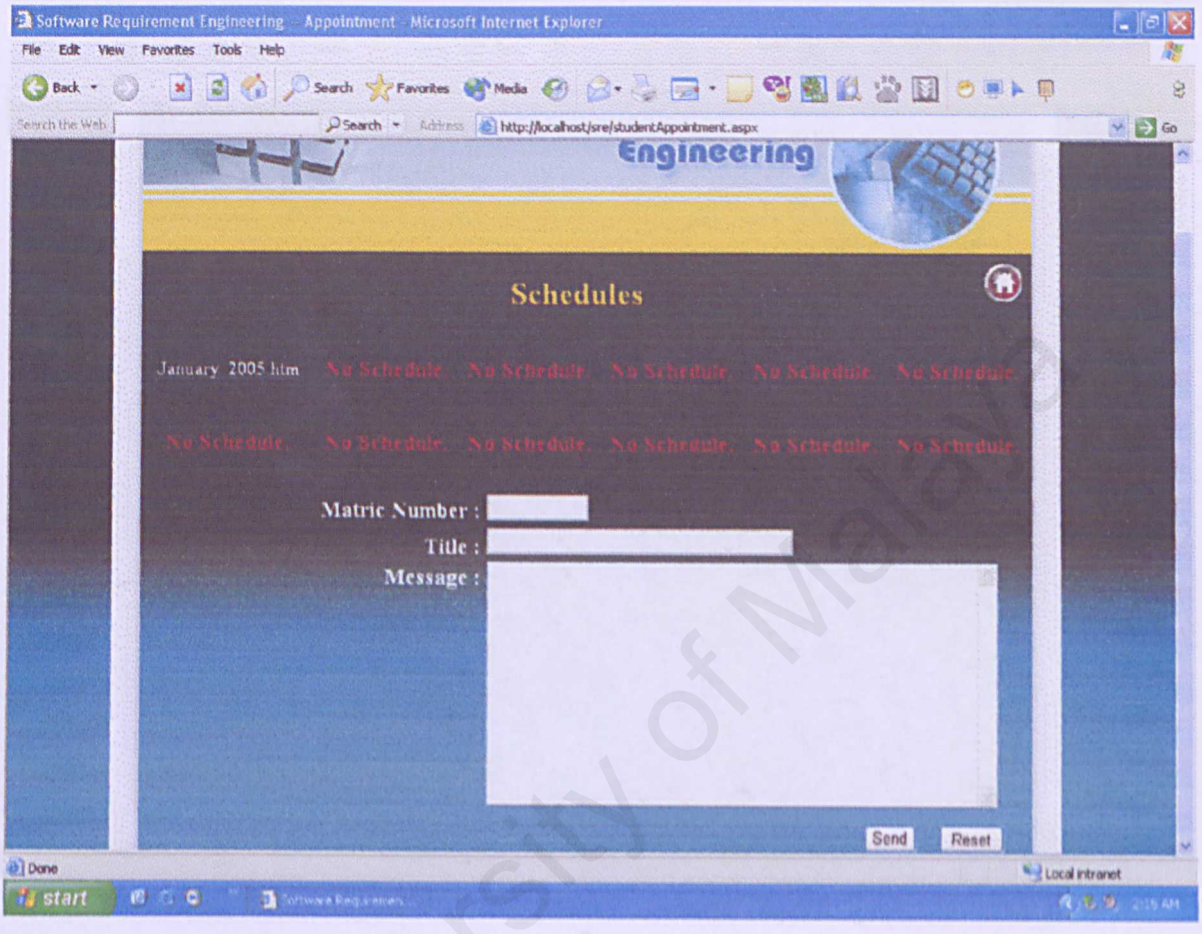


1. This page is provided for students to download other files such as "Course Information" or "Assignment" by just clicking on name of the file displayed.

2. Students can also know the actual size (in bytes) of file that will be downloaded.

3. By clicking on "home" button, the page will then back to the first page of the student module.

Figure 3.5 Making Appointment



1. This page is provided for students to view monthly schedules that are prepared by lecturer.

2. Students can make appointments with lecturer by sending messages to lecturer.

3. All fields are required to fill before the system allows any message to be sent to database to be viewed by lecturer.

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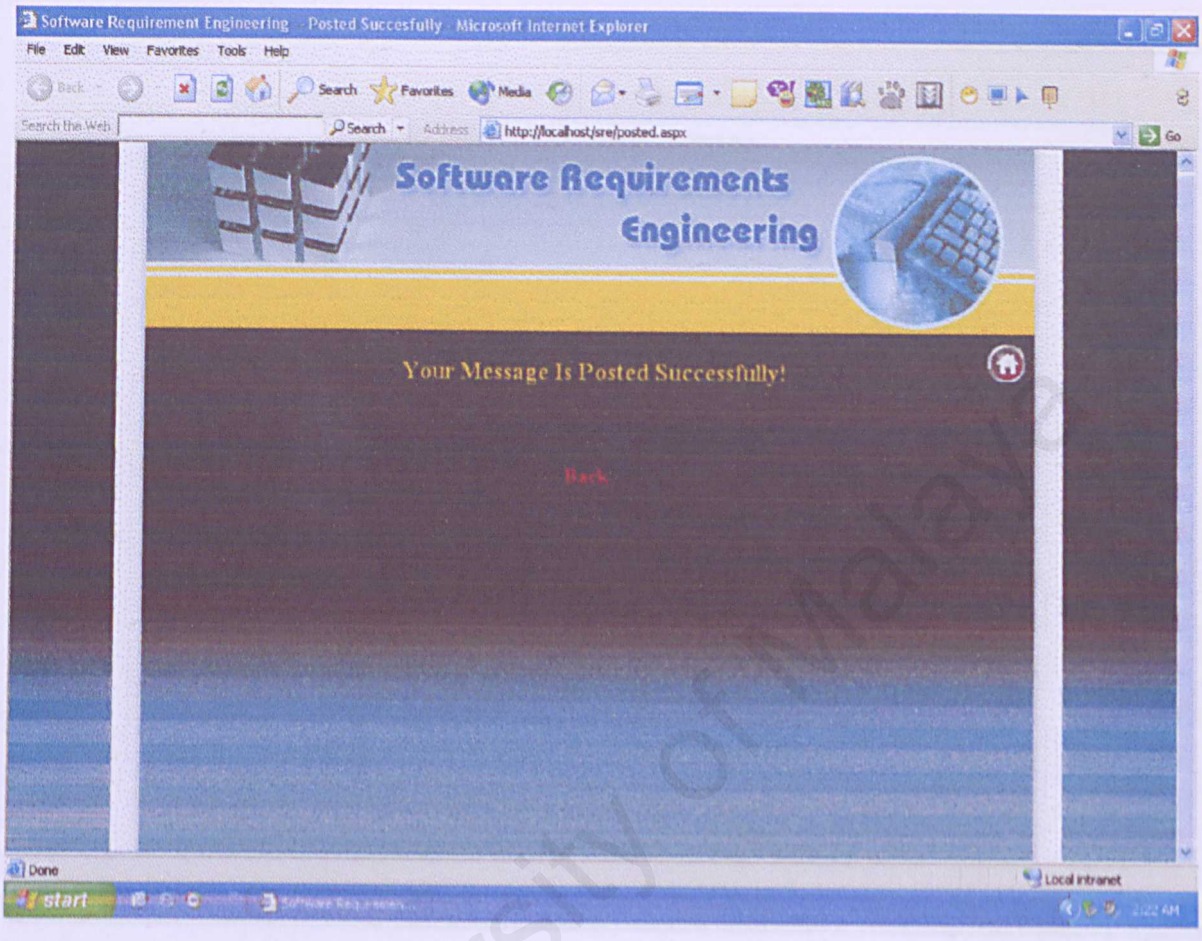
Figure 3.5 Posted Successfully



1. If the message above is posted successfully, this page will be displayed to confirm that the message is sent.

2. Students can either click on "Home" button or "Back" to return to first page of student module or "Making Appointment" page respectively.

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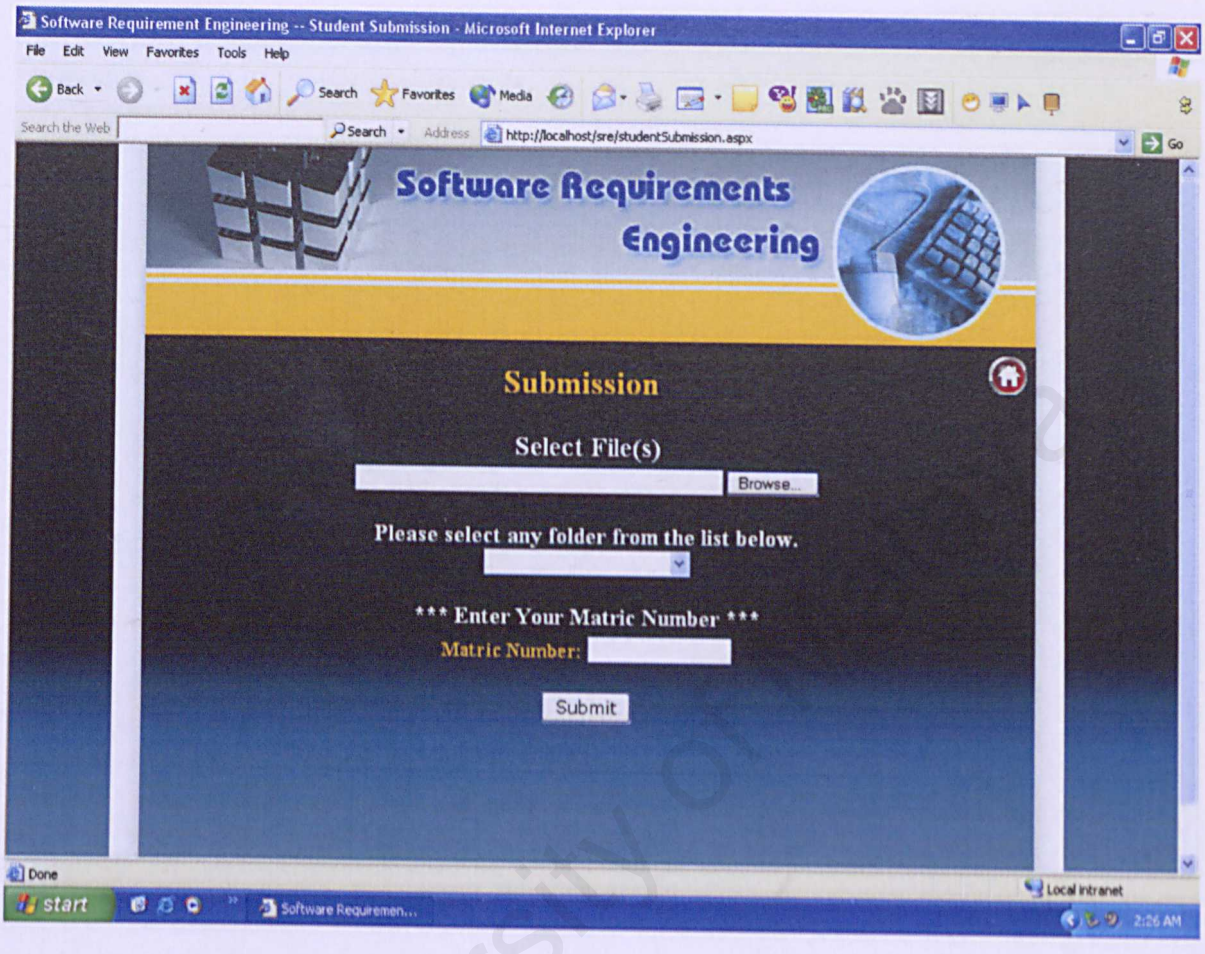
Figure 3.6 Student Submission



1. This page is provided for students to submit their files such as assignments or tutorials.

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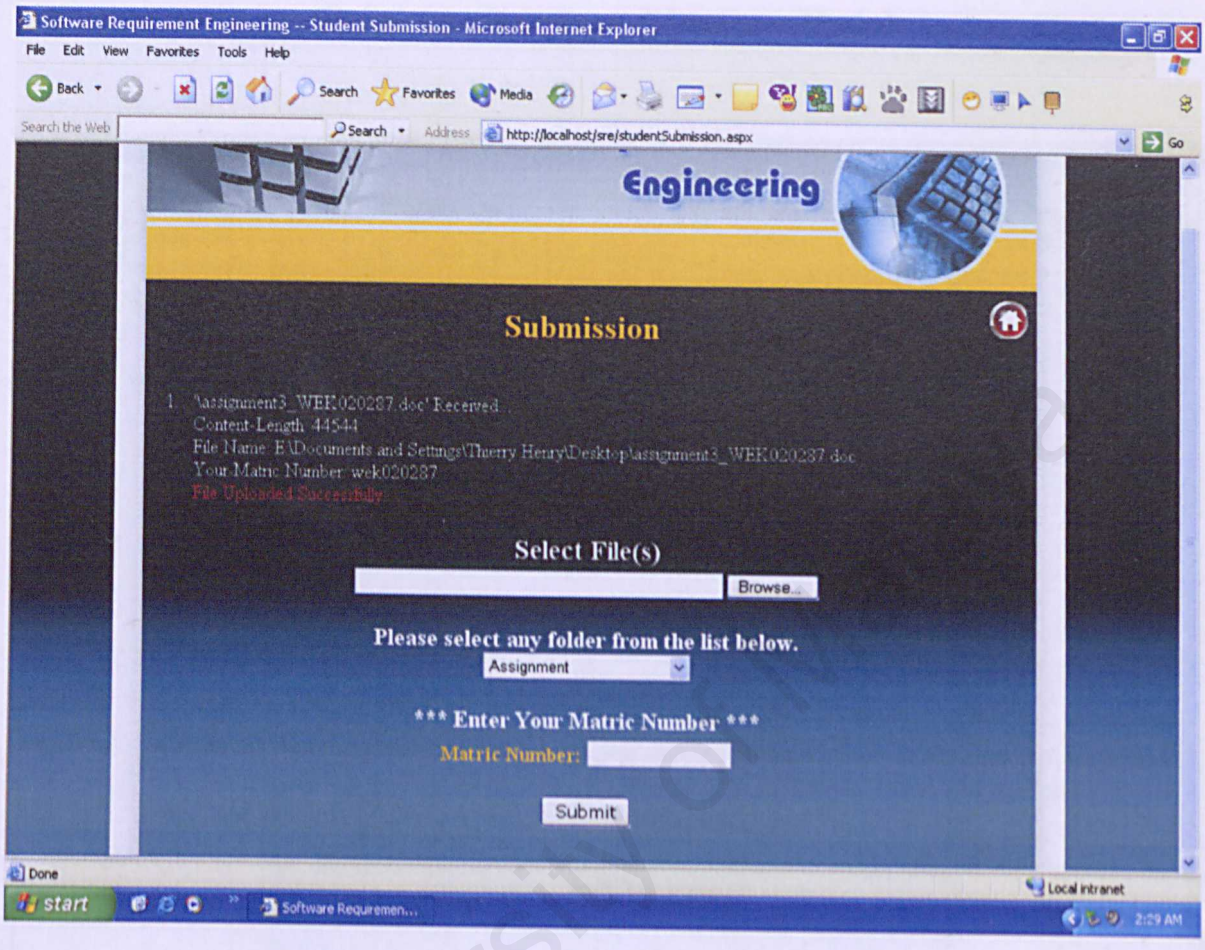
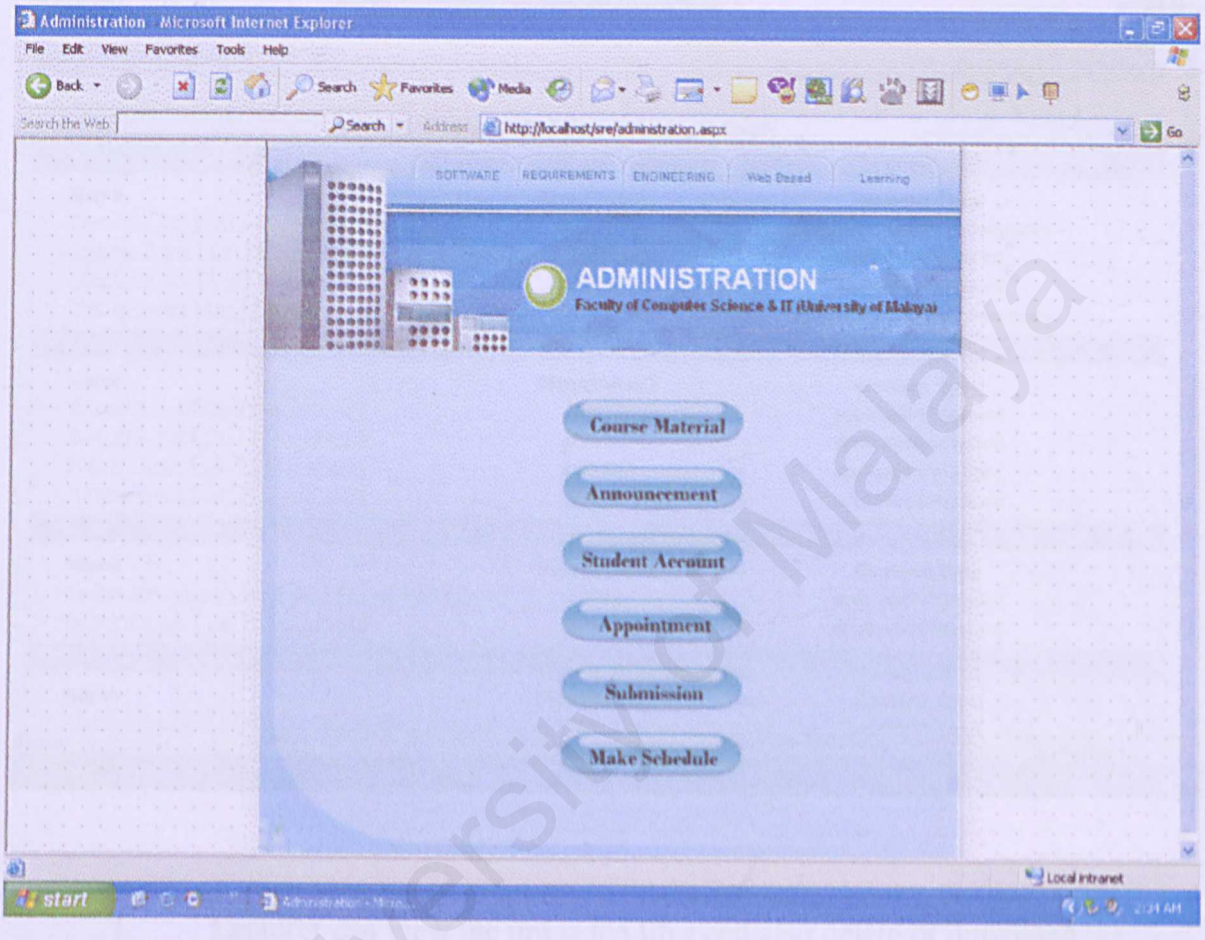
Figure 3.7 Submitted Successfully



1. If the file above is submitted successfully, this message will be displayed to confirm that the message is sent.

Chapter 4: Browse by Lecturer (Lecturer Module)

Figure 4.1 First Page of Lecturer Module



1. Lecturer can click on particular button to display a new page for further administration or management of the system.

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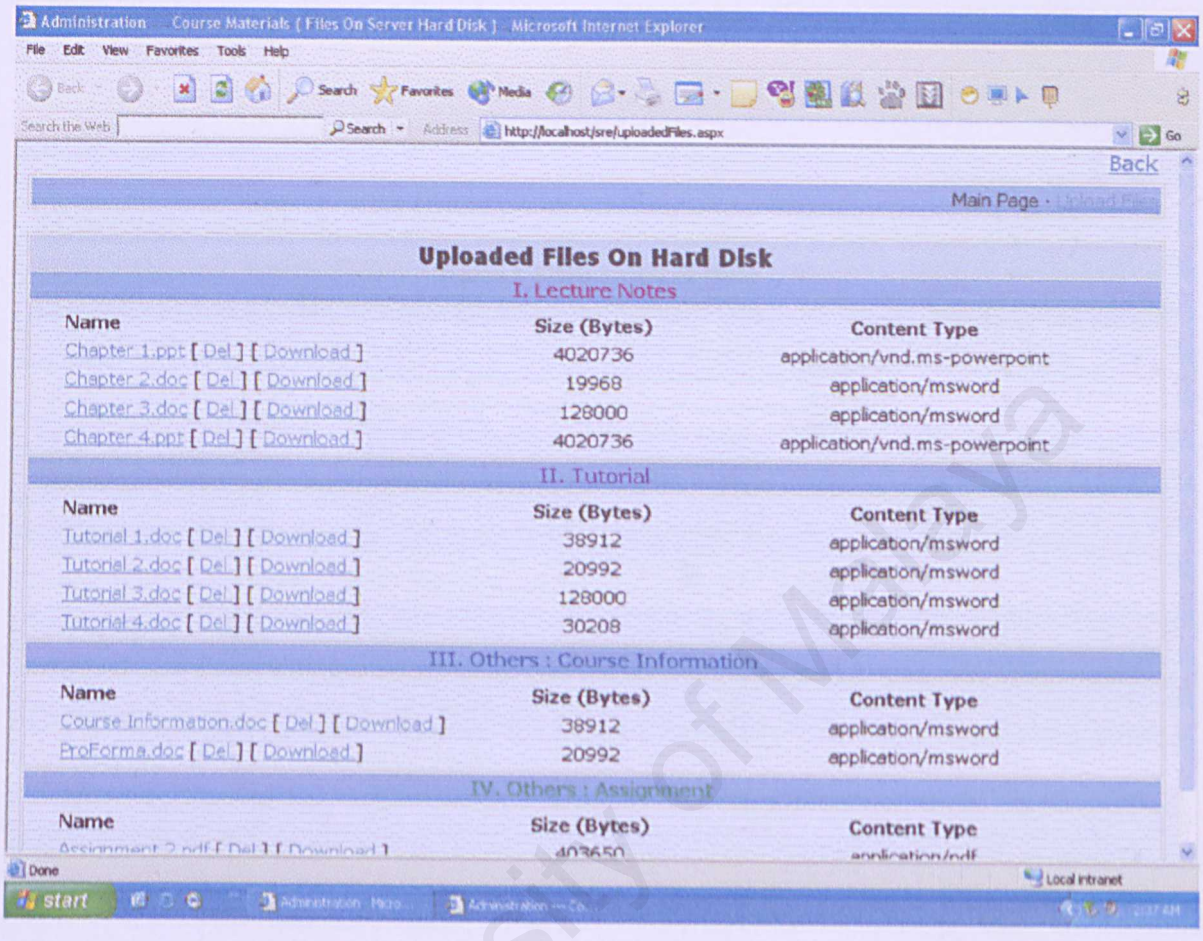
Figure 4.2 Course Materials Page



1. Lecturer can view the uploaded files and also delete or download the files if he/she would like to do so.

2. Lecturer can also upload file by clicking on "Upload Files" in order to display an "Uploading Files" page.

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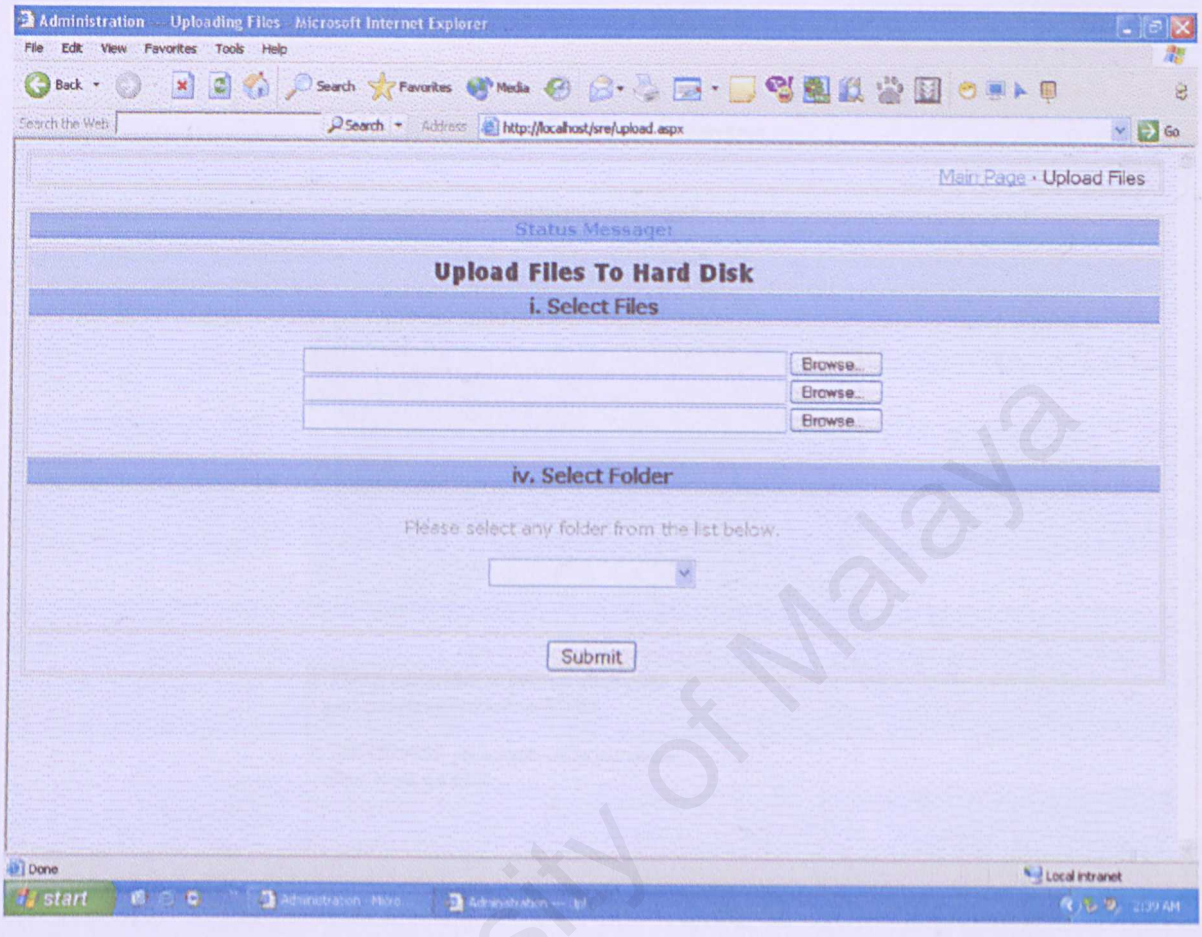
Figure 4.3 Uploading Files Page



1. Lecturer can upload file to particular folder by select the folder from the list prepared.

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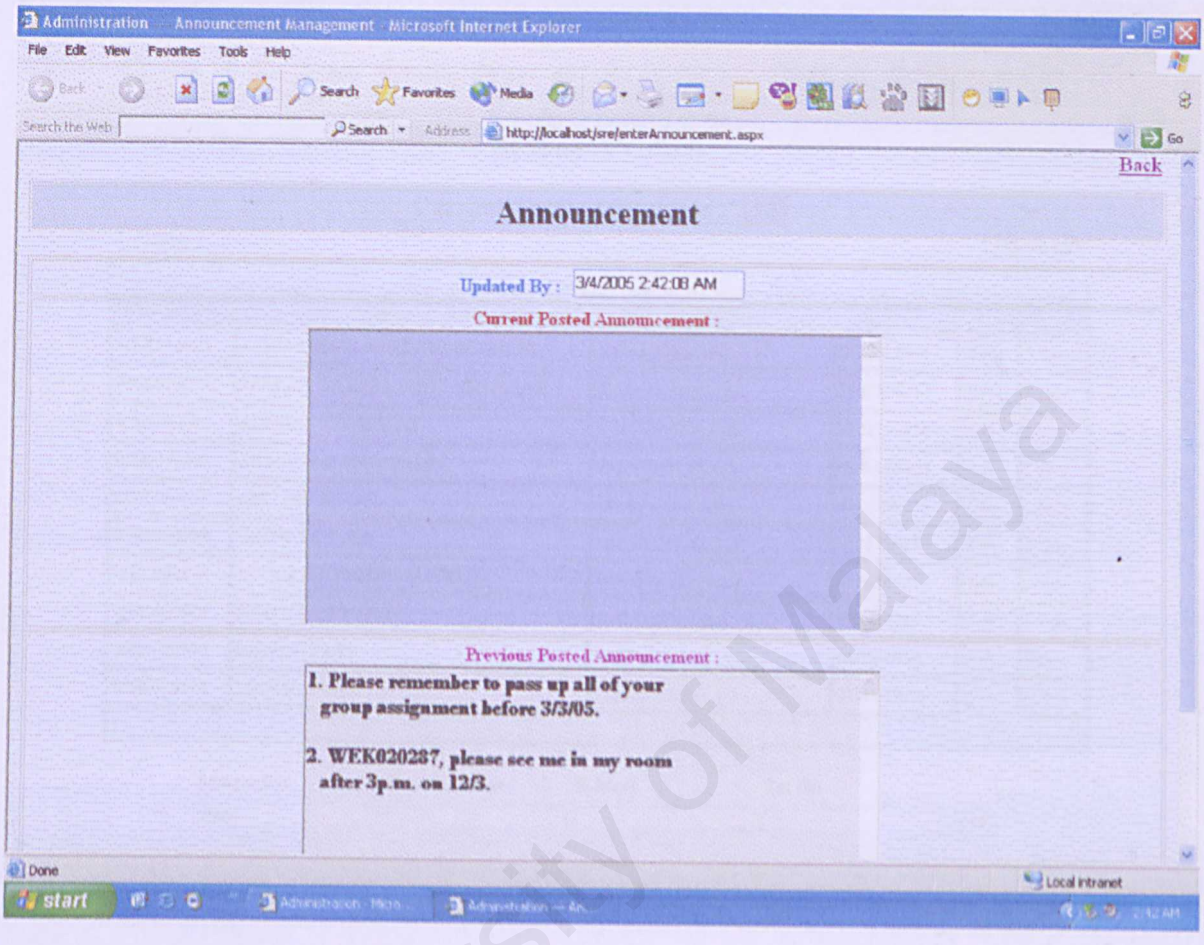
Figure 4.4 Announcement Page



1. Lecturer can make the latest announcement by typing the announcement in "Current Posted Announcement". Then click "Submit".

2. Lecturer can refer to the previous announcement to know the announcement that he/she made before.

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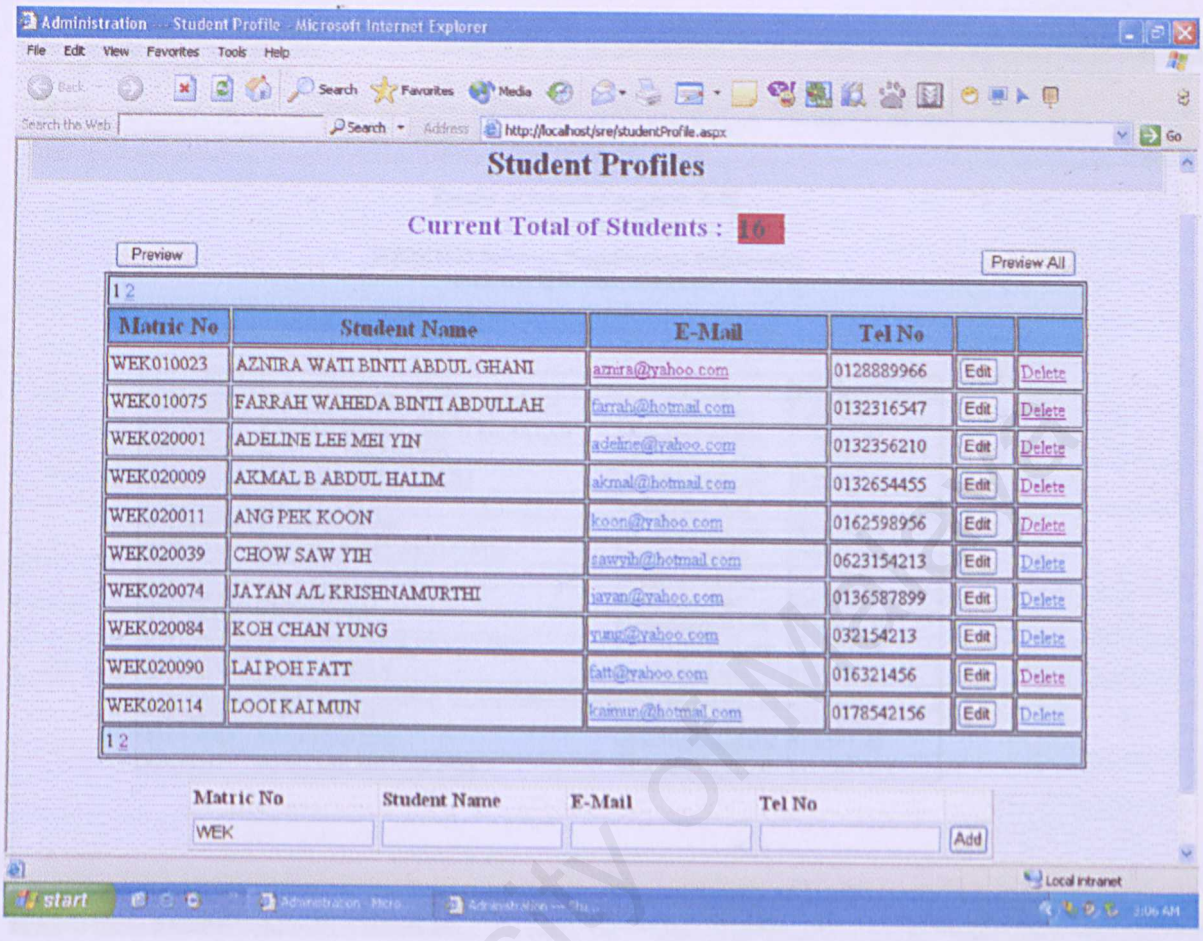
Figure 4.5 Managing Student Profiles Page



1. Lecturer can add the details of a new student by inserting the information and then click "Add" button.

2. Lecturer also can update student profiles by click "Edit" and then do any changes.

3. Besides, lecturer can view print preview of student profiles by clicking "Preview" or "Preview All" before printing.

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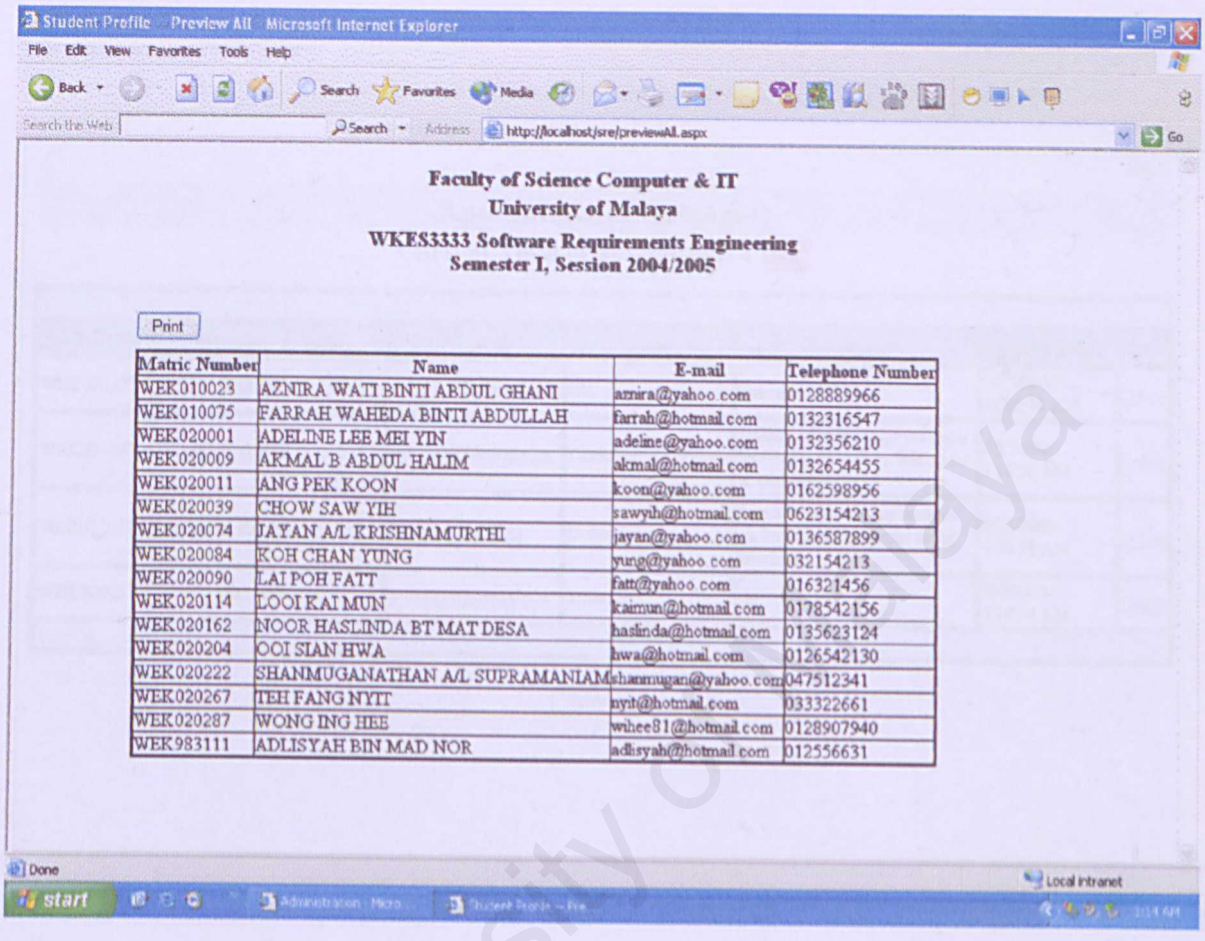
Figure 4.6 Printing Student Profiles



Matric Number	Name	E-mail	Telephone Number
WEK010023	AZNIRA WATI BINTI ABDUL GHANI	aznira@yahoo.com	0128889966
WEK010075	FARRAH WAHEDA BINTI ABDULLAH	farrah@hotmail.com	0132316547
WEK020001	ADELINE LEE MEI YIN	adeline@yahoo.com	0132356210
WEK020009	AKMAL B ABDUL HALIM	akmal@hotmail.com	0132654455
WEK020011	ANG PEK KOON	koon@yahoo.com	0162598956
WEK020039	CHOW SAW YIH	sawyih@hotmail.com	0623154213
WEK020074	JAYAN A/L KRISHNAMURTHI	jayan@yahoo.com	0136587899
WEK020084	KOH CHAN YUNG	yung@yahoo.com	032154213
WEK020090	LAI POH FATT	fatt@yahoo.com	016321456
WEK020114	LOOI KAI MUN	kaimun@hotmail.com	0178542156
WEK020162	NOOR HASLINDA BT MAT DESA	haslinda@hotmail.com	0135623124
WEK020204	OOI SIAN HWA	hwa@hotmail.com	0126542130
WEK020222	SHANMUGANATHAN A/L SUPRAMANIAM	shanmugan@yahoo.com	047512341
WEK020267	TEH FANG NYIT	nyit@hotmail.com	033322661
WEK020287	WONG ING HEE	whee81@hotmail.com	0128907940
WEK983111	ADLISYAH BIN MAD NOR	adlisyah@hotmail.com	012556631

1. Lecturer can just click on "Print" button to print the student profile that is displayed on screen.

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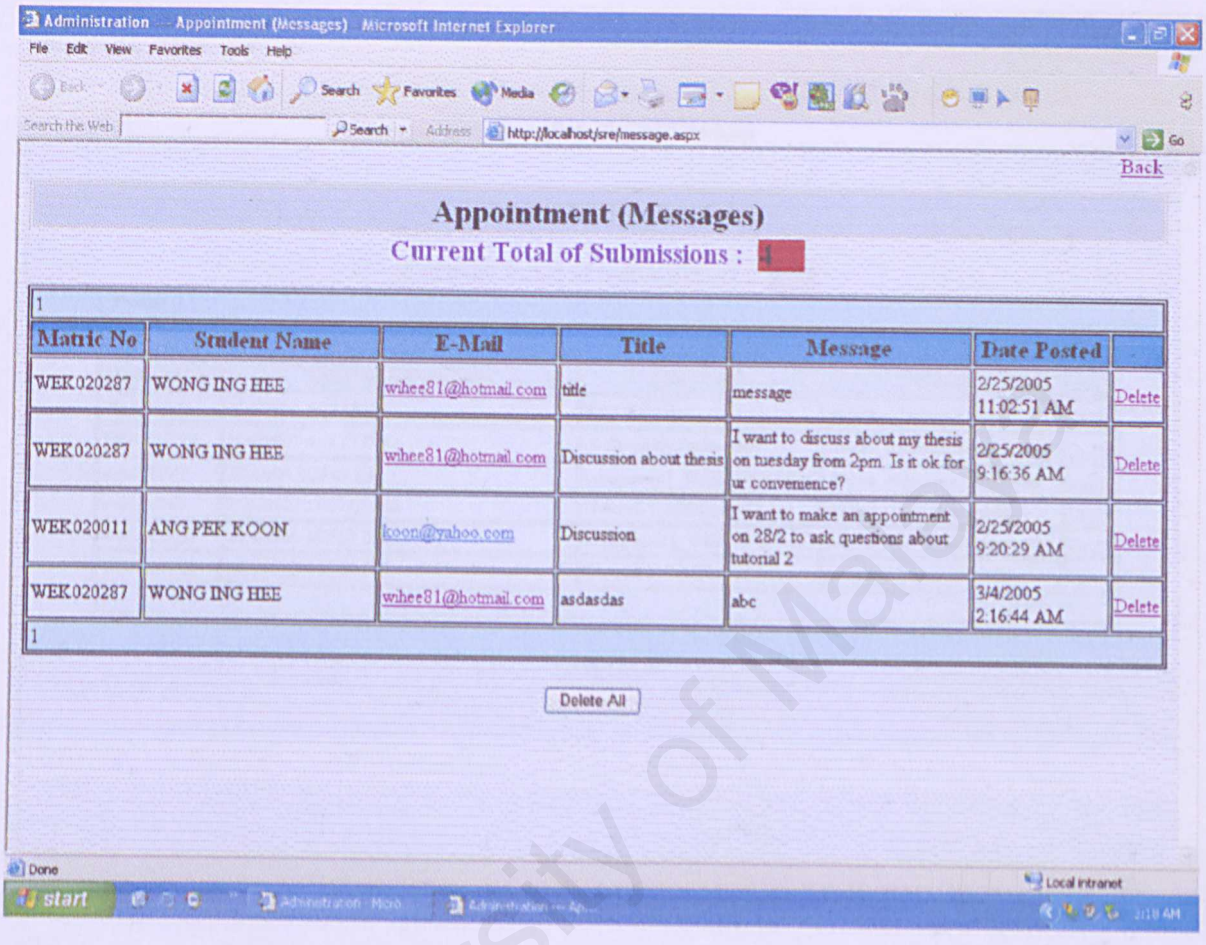
Figure 4.7 Viewing Appointment Made by Students



1. Lecturer can just click on the link of student's e-mail address to send a mail for confirmation to the student whether lecturer accepts the appointment made by student or not.

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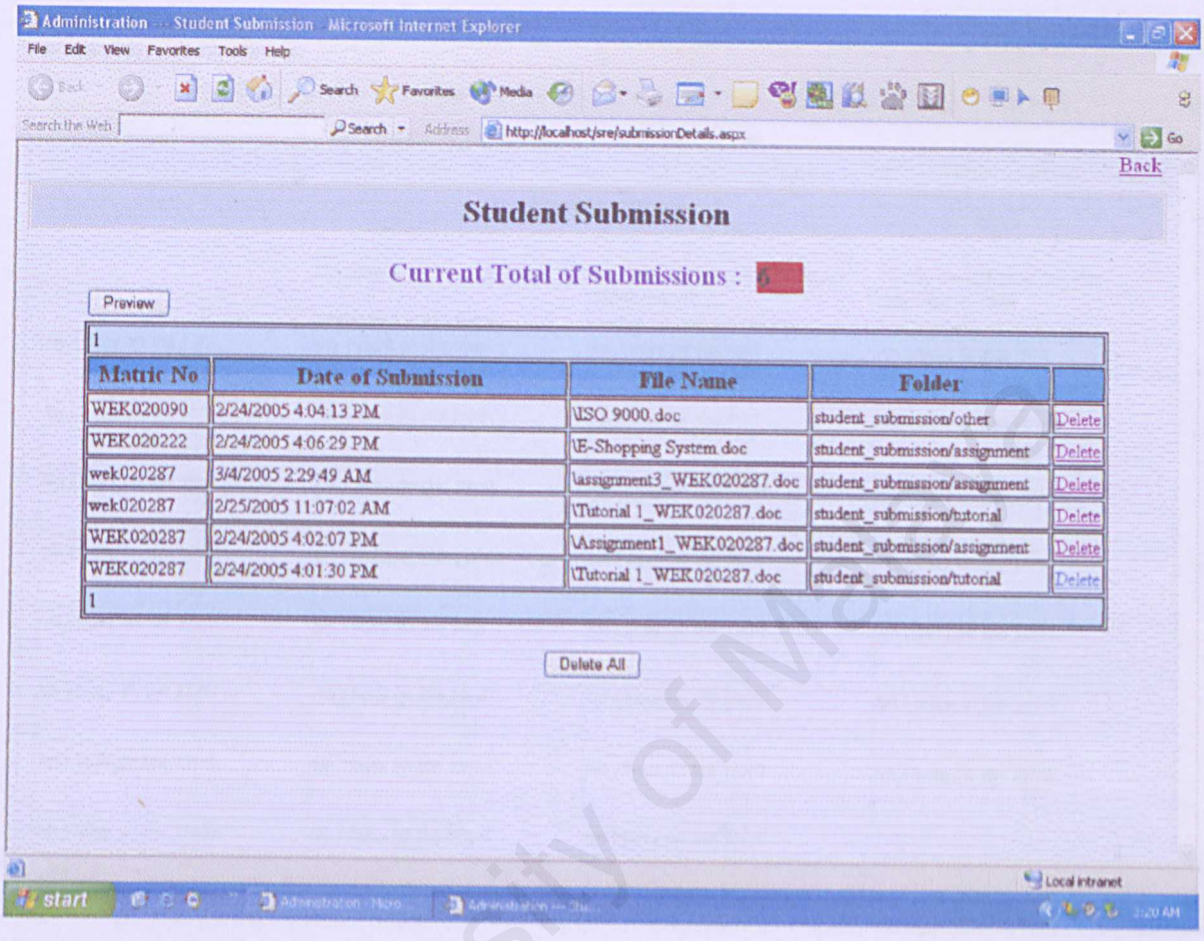
Figure 4.8 Viewing Student Submissions



1. Lecturer can view the details of the student submissions especially the date and time of the submissions.

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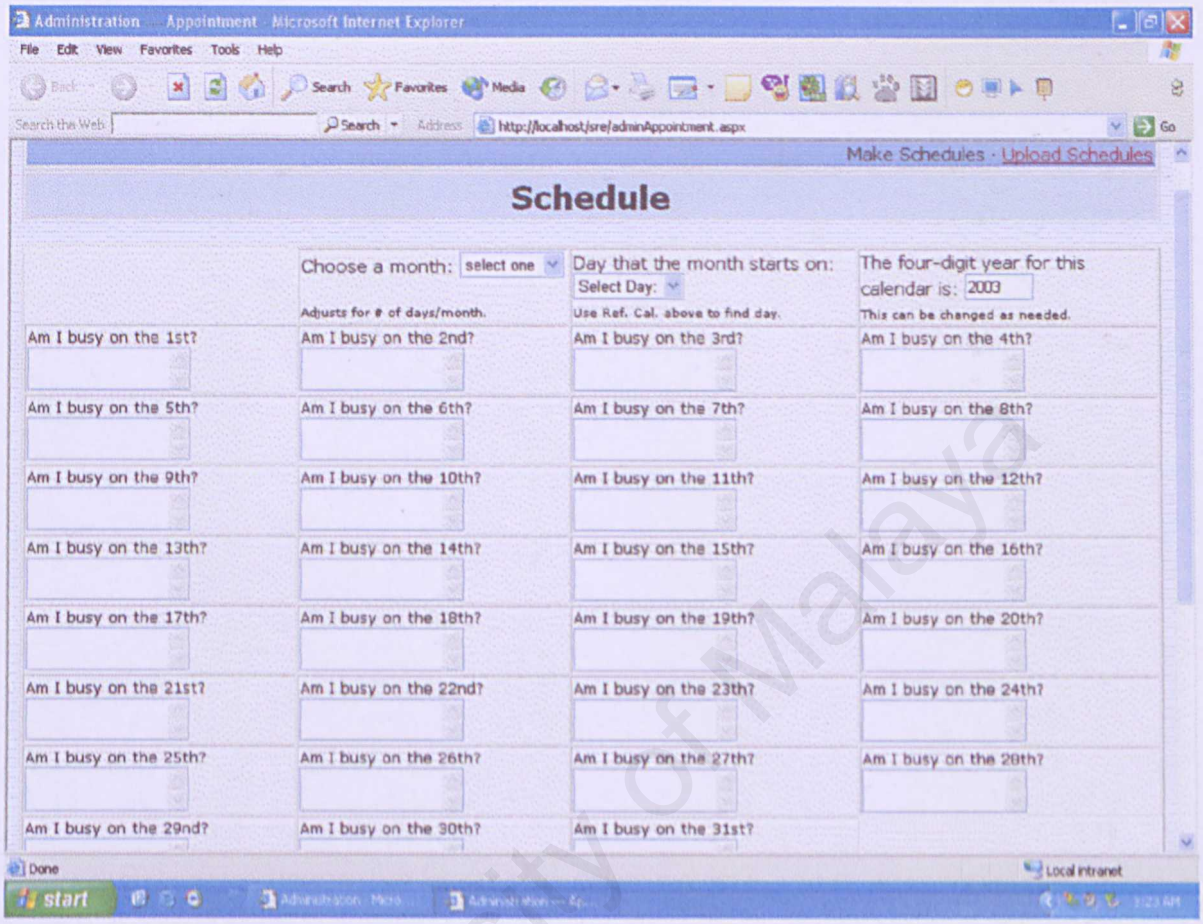
Figure 4.9 Making Schedule



1. Lecturer can make a calendar or schedule by just inserting the events in the boxes provided. Then click "Make Calendar". The system will make a schedule with the colours such as background or text that has been selected by lecturer.

2. Lecturer then can upload the schedule made by clicking "Upload Schedules" and upload the schedule through the page.1

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